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THE MONIST

CHRISTIAN THEOPHAGY: AN HISTORICAL SKETCH.

I. PRAEPARATIO EVANGELICA.

THOSE who have attended the celebration of a mass have witnessed the most ancient survival from a hoary antiquity. There, in the often beautiful church, in gorgeous vestments, with incense and chanted liturgy, the priest sacrifices a God to himself and distributes his flesh to be eaten by his worshipers. The Divine Son is offered to the Father as "a pure victim, a spotless victim, a holy victim,"[1] and his holy body and blood become the food of the faithful. The teaching of the Church is explicit on this point. The body eaten is the same as that once born of a virgin and now seated at the right hand of the Father; the sacrifice of the mass is one and the same as that of the cross, and is so grateful and acceptable to God that it is a suitable return for all his benefits, will expiate sin, and turn the wrath of the offended Deity "from the severity of a just vengeance to the exercise of benignant clemency."[2]

All this goes back to the time when man was just emerging from the animal; it is the most striking of the many instances of the conservatism of religion. The further back we go historically the more religious do we find our ancestors; the story of progress has been one of constant secularization. But there was a prehistoric time when there

[1] *The Missal*: Canon of the Mass.

[2] *Catechism of the Council of Trent*, transl. by J. Donovan, 1829, pp. 156ff.

was nothing that we would recognize as religion at all. Behind the savage culture that we know, when religion rules the tribes with a rod of iron, there must have been a period when the grandsons of the ape were accumulating their theological ideas. Their first concept was not, apparently, that of personal gods, but that of a vast mystery; it was the weird or uncanny quality of certain things they did not understand. Along with this was the overmastering power of tribal custom. They had the conservative instinct to the highest degree; as children and savages and certain neurotics[3] to-day, they felt an imperative need, the reason of which they could not explain, that things should be done in the ways to which they were accustomed. The real reasons, of course, lay deep in the laws of habit and imitation; but, because they could not understand this, they gave their acts a mysterious sanction, the taboo. It was in this, and the related idea of "mana," both of them founded in the sacredness, i. e., mysteriousness, wierdness, of certain objects and acts, that the germs of all religions lay. In the earliest stages the ape-men were unable to conceive of anything very personal and definite as god. Not only was the conception of Being "without body, parts or passions" impossible to them, but even an anthropomorphic god was too abstract. Nor was this period so remote as we sometimes think. Just as in Latin the word *sacer*, meaning both "sacred" and "accursed," retains the old connotation of "taboo," so in Greek θεός was used with a far wider significance than we should use the word "god." The fact of success was a "god" and more than a "god"; to recognize a friend after long absence is a "god"; wine is a "god" whose body was poured out in libation to the gods.[4] Nor was this mere poetry or philosophy; it was, to the speakers, literal prose.

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[4] G. Murray, *Four Stages of Greek Religion,* 1912, p. 26.

This earliest stage of theology was totemism, at one time probably universal. The totem was a specially sacred thing connected, by some fancied resemblance, with the tribe—at that period Church and State in one. It was a sort of dreadful mascot; a thing usually an animal, that was felt to be akin to the tribe and that could bring both bad luck and good according to the treatment it received. Ordinarily it was treated with reverence, awe and fear; it could not be killed or annoyed. But at times when things were going badly, or there was urgent need of stimulating the crops on which the existence of the people depended, or the bravery of the men or the fecundity of the women which were no less essential, some more drastic form of government regulation of totems was felt to be desirable. How could the tribe absorb the good qualities of the sacred thing; its "mana," as some of us, or "grace," as others would say?

Compared with the first mystics who brooded over the problem of union with the divine, Caliban was a gentleman and a scholar, the exquisite flower of a long refinement by civilization. Practically the whole content of their experience, as far as it gave them any suggestion of union, was food and sex. The "god" must be either eaten, or united with his worshipers in sexual intercourse.[5] Both ideas have colored the language and thought of all religions, including Christianity.

The eating of the sacred animal, or, later, of the god in the form of an animal, is the one with which we are at

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The eating of an animal or in some cases a human being in the same sacramental way, has been found also in Australia,[10] in Nigeria, and among North American Indians.[11]

But the totem was not the only divine being eaten. In the primitive sacrament of the first-fruits, the spirit of the corn was thus absorbed by his votaries. Thus in Wendland, Sweden, to the present day, "the farmer's wife uses the grain of the last sheaf to bake a loaf in the shape of a little girl; this loaf is divided among the whole household and eaten by them. Here the loaf represents the corn-spirit conceived as a maiden." "The new corn is itself eaten sacramentally, that is, as the body of the corn-spirit."[12] A similar custom is found in Lithuania.[13]

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Among the heathen Cheremiss on the Volga, when the first bread from the new crop of wheat is to be eaten, the villagers assemble in the house of the oldest inhabitant, open the eastern door and pray with faces toward it. The sorcerer or priest then gives each a mug of beer to drain; next he cuts and hands to every person a morsel of bread. "The whole ceremony," says the writer who has described it, "looks almost like a caricature of the eucharist."[15] In fact it is its crude prototype.

The Incas of Peru also ate bread and drank liquor in a manner compared by the Spaniard to the eucharist.[16]

The Aino of Japan also regard their cereal offering as an eaten god,[17]and the East Indians, Buru, call their sacramental meal "eating the soul of the rice."[18] "In all such cases," observes Frazer, "we may not improperly describe the eating of the new fruit as a sacrament or communion with a deity, or at all events with a powerful spirit." In many cases the rite was preceded by the administration of a purgative or emetic, the idea being to preserve the sacred food from contact with profane nourishment. Thus the Catholics take the eucharist fasting.[19]

In some cases the sacrament of the first-fruits was combined with a sacrifice or offering of them to the gods or spirits, and at times the latter element of the rite throws the earlier into the shade.[20] Here, too, the analogy with

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the mass is striking, as in the connection made by Paul between the feast of unleavened bread, "Christ our passover sacrificed for us," and Christ the "first-fruits of them that slept."[21]

The custom of eating a god sacramentally was practised by the Aztecs before the discovery of Mexico. Twice a year, in May and December, an image of the great god Vitziliputzli was made of dough and then broken in pieces and solemnly consumed. Acosta says that the Aztec virgins made the paste of beets and maize, which they called the flesh and bones of Vitziliputzli, and adored as such. Then, after a holocaust of victims, the priests distributed the dough after the manner of communion. The people said that they ate the flesh and bones of God. A similar mystic communion was held by the Brahmans in India, upon which Frazer remarks: "On the whole it would seem that neither the ancient Hindoos nor the ancient Mexicans had much to learn from the most refined mysteries of Catholic theology."[22]

At the festival of the winter solstice the Aztecs first killed their god Huitzilopochtli in effigy and then ate him. They made their idol in the form of a man, from various seeds, with bones of acacia wood. A priest, who took the name and part of the god Quetzalcoatl pierced the image through and through, which was called killing it. Then they cut out the heart, which was given to the king, and divided the rest among the people. The name of the festival was "god is eaten."[23] As we shall see later on, at one time the Christian host was baked in the form of a man and stabbed by the priest.

When the Mexicans craved a closer union with the living god, they endeavored to attain it by cannibalism; making a man impersonate their deity and then devouring

[21] 1 Cor. v. 7f; xv. 20. [22] Frazer, *Spirits*, II, 89. [23] *Ibid.*, 90.

him.[24] A curious survival of communion with a god by eating his image is found among the Huichol Indians of Mexico, who have an idol carved from lava, bits of which they scrape off with their nails and eat.[25]

The Hindus furnish two further customs which are also found in Christianity. The Malas eat a goddess in effigy at the time of their marriage,[26] just as Catholics commune before wedding.[27] The Veddas of Ceylon make an offering to the spirits of the dead, which they eat sacramentally, believing that it will give them health and good luck. They even extend this inestimable privilege to their dogs, hoping that the heavenly food will make them better hunters.[28] Even so at the "palio," a horse-race held for centuries twice every year at Siena, which I myself have witnessed,[29] before the race the horses and jockeys are taken into a church, where the host is offered to the jockey to kiss and to the horse to smell. This powerful charm did not, however, when I witnessed the race, prevent one of the blessed riders from getting a bad fall.

But not all our examples of god-eating are to be found among "the beastly devices of the heathen." "In Europe the Catholic Church has resorted to similar means for enabling the pious to enjoy the ineffable privilege of eating the persons of the Infant God and his Mother. For this purpose images of the Madonna are printed on some soluble and harmless substance and sold in sheets like postage stamps. The worshiper buys as many of these sacred images as he has occasion for, and, affixing one or more of

[24] *Ibid.*, 92. [25] *Spirits*, II. 93. [26] *Ibid.*

[27] Decree of Council of Trent, C. Mirbt, *Quellen zur Geschichte des Papstthums und des römischen Katholizismus*, 3d ed., 1911, 251.

[28] C. G. Seligman, *The Veddas*, p. 130, quoted W. M. Groton, *The Christian Eucharist and the Pagan Cults*, 1914, 8.

[29] I saw the race, but not the consecration of the horses. This was witnessed by my sister, Dr. Winifred Smith, of Vassar College. So in Spain, I am informed, bullfighters take the sacrament before they enter the arena. As the danger of death is almost nil, it is probably conceived as a charm to strengthen them.

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them to his food, swallows the bolus.... In his youth Count Hoensbroech and his devout mother used to consume portions of God and his Mother with their meals." The practice was officially sanctioned by a decree of the Inquisition, in July, 1903.[30]

It is a fact of the highest importance that the sacramental meal attained great prominence in many religions among the peoples of the Mediterranean during the centuries just preceding and just following the rise of Christianity. Such meals were in many cases interpreted by a refined culture in a way less gross than had been the case earlier. They were compared to the banquets given at funerals in memory of the dead; they were likened to the common meals at Sparta and elsewhere;[31] they were communion with the god simply in that he was the host and the worshipers his guests. Thus dinners of a purely social nature were sometimes held in temples in order to enjoy the company of the god.[32] But the fundamental idea, vaguely expressed but always present, was the old one, that the consecrated food was the means of obtaining obsession by a good spirit, of becoming identified with the god of the Mystery.[33] Caution had to be exercised lest bad demons would also enter the body of the communicant. So comparatively enlightened a philosopher as Porphyry[34] assures us that demons delight in impure meats and enter those who use them.

Fanatic Egypt saw nothing incongruous in treating her gods like cattle from whose milk or flesh divinity could be extracted. One of her Pharaohs achieved immortality by sucking the breast of a goddess;[35] another took a more

[30] Frazer, *Spirits*, II. 94.

[31] P. Gardner, *Religious Experience of St. Paul*, 1911, 110.

[32] *Papyri Oxyr.*, I, 110, edited by Milligan, p. 97; cf. Carpenter, *Phases of Early Christianity*, 251ff.

[33] K. Lake, *Earler Epistles of St. Paul*, 196.

[34] Eusebius, *Praeparatio evangelica*, IV, 23.

[35] Dietrich, 101.

drastic method: "His servants," we are told, "have captured the gods with a lasso, they have found them and brought them down, have bound them and cut their throats and taken out their entrails and carved them and cooked them in hot cauldrons. The king consumes their power and eats their souls. The great gods are his breakfast, the middle-sized ones his dinner and the small ones his supper. . . . .The king consumes all that comes to him. Eagerly he swallows all their magic power. He becomes an heir of might, greater than all heirs; he becomes lord of heaven, for he ate all the crowns and bracelets; he ate the wisdom of every god."[36]

The blood of Osiris was a great charm, which, poured in a cup of wine, made Isis drinking it feel love for him in her heart.[37] When the blood could not be procured, its place was taken by simple wine, consecrated by this hocus-pocus said seven times: "Thou art wine and not wine but the head of Athene. Thou art wine and not wine, but the bowels of Osiris."[38]

From Persia marched forth Mithra to dispute the empire of the world with Christ. His warriors told how the hero Saoshyañt would kill a bull and of his fat, mingled with the juice of the white haoma, would prepare a beverage assuring immortality to all who tasted it.[39] That the bull was a divine animal goes without saying, for how otherwise could his flesh be the "drug of immortality"?[40] The sacramental banquet, however, was also a love-feast, done in remembrance of the supper celebrated by the sun before his ascension.[41] It could only be partaken of after long initiation, and was rightly regarded at Rome as "a

[36] *Ibid.*, 100.

[37] Griffith, *Demotic Magical Papyrus*, p. 107. Reitzenstein, *Die hellenistischen Mysterienreligionen und Paulus*, 1910, 204.

[38] Kenyon, *Greek Papyri*, I, 105; Reitzenstein, 205.

[39] Dietrich, 102.

[40] As Ignatius called the eucharist. *Ad Ephesios*, 20.

[41] F. Cumont, *The Mysteries of Mithra*, 1903, pp. 158ff.

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magical meal."[42] So similar was it to the Christian Supper that Justin Martyr informs us it was directly imitated from the institution of Christ by evil demons, who, "in the mysteries of Mithra, set forth bread and a cup of water with certain explanations in the ceremonial of initiation."[43] Tertullian also noted the resemblance, so dangerous for simple souls, between Mithraism and Christianity.[44]

Attis, the Phrygian god who was born of a virgin, and who died and rose again at Easter time, also left his followers a sacramental meal.[45] His worshiper could say: "I have eaten from the drum, I have drunk from the cymbal, I have carried the earthen dish." From pictures we know that this latter was carried on the head in exactly the style in which, in the Greek Church, the holy food of the eucharist was carried by the deacons.[46] Another point of similarity between the communions of Attis and Christ was the use in each of fish.[47]

The connection of fish with the eucharist, made as early as the composition of the Gospel of Mark,[48] and witnessed by inscriptions in the catacombs,[49] is another case of the absorption by the conquering cult of the elements of vanquished superstitions. One cannot, indeed, explain it, as has been done,[50] by saying that "Jesus found at Bethsaida . . . a local pagan cult of the widely-spread fish-god, availed himself of it, and spiritualized it by means of an etymolog-

[42] Dietrich, 102. Pliny, *Hist. Nat.*, XXX, 1, 6.

[43] Justin Martyr, *First Apology*, I, 66; Clemen, *Primitive Christianity and its Non-Jewish Sources*, 1912, 261.

[44] Reinach, *Cultes, Mythes et Religions*, 1905ff, II, 227.

[45] Frazer, *Adonis*, I, 272ff, 309f. [46] Dietrich, 103f.

[47] M. Brückner, "Attis," *Die Religion in Geschichte und Gegenwart*, 5 vols., 1909ff.

[48] Mark vi. 38; Matt. xiv. 17; Luke ix. 13. That this meal was eucharistic will be shown later.

[49] An epitaph at Rome, dating 100-130, represents the eucharist by loaves and fishes. M. Goguel, *L'Eucharistie des origines à Justin Martyr*, 1910, 279.

[50] Eisler, *Transactions of Third International Congress of Religions*, II, 352.

ical coincidence between *lehem*, bread, *luhm*, fish, and *luhm*, breath or spirit." This is too uncritical of the documents, and assumes too much history in them. But of the connection there can be no doubt. Dagon, meaning "fish," was worshiped by the Philistines (Judges xvi. 23), and Lucian tells us of fish kept in sacred fountains from which they were ritually taken and eaten.[51] The designation of Christ as Ἰχθύς was not, as commonly stated, an anagram, but a genuine case of syncretism. He was called the Big Fish and his worshipers little fishes. Thus an ancient Christian inscription of Abercius says: "Faith shows me my way everywhere and furnishes my food: even a fish from a fountain, large and pure, which a chaste virgin captures." An allusion to baptism is often seen in this, though it much better suits the eucharist, or perhaps the ancient custom of administering the eucharist immediately after baptism. In former centuries eating fish was symbolic of eating Christ's flesh, just as now it is eaten by Catholics on fast-days, especially as a preparation for communion.

Rome, too, did not lack her sacramental meals. One of the titles of Jupiter was "dapalis," "he of the feast," and the priest who presided at the sacrifice was called "epulo," "feaster."[52] At ancient Aricia, near Rome, it is believed that loaves were baked in the image of the King of the Wood and eaten sacramentally.[53]

Something has been made of the fact that the students of comparative religion have found the eating of a god in so many and diverse religions. Surely, it is said, one key is too simple to fit so many locks; the day of the vegetation god, killed and eaten and reviving will go the way of the sun-god theory of Max Müller. When one sees the vegetation myth in Australia and Mexico, in Orestes and Ham-

[51] Reinach, C. M. R., III, 46ff.

[52] Dietrich, *229*.

[53] Frazer, *Spirits*, II, 95.

let,[54] he must be the victim of a monomania. But it is certain that many other religious ideas, whether true or delusive, the existence of gods, immortality, the power of witchcraft, have until recently been held all but universally: *semper, ubique et ab omnibus.* Communion with a god by eating him is just one of those ideas which arise naturally in a certain stage of culture, and, under myriad forms, survive in a hundred different societies. A similar one is baptism; the idea found in very many cults, that, by washing, a man can cleanse his soul as well as his body.

So in Greece we find the pre-Christian communion in many forms. After the great age of art and philosophy there was a reaction which Gilbert Murray has called "The Failure of Nerve." The hungry generations trod men down as they had never done before; there went up a great cry for respite from this world, for salvation. To supply this neeed arose the Mystery Religions, of which Orphism is a good example, promising rest for the soul and union with God. But they kept the old forms to a great extent, particularly the myth and ritual of the god torn to pieces and devoured by his adorers.

Traces of this belief are found in the ancient Minoan civilization.[55] A god was there sacrificed in the form of a bull, possibly at some earlier period than we know in the form of a child.[56] In many an old Greek legend we see the original sacrifice and devouring of a divine animal. So common were these *motivs* that Greek has special words to designate them: σπαραγμός for the ritual tearing of the animal to pieces and ὠμοφαγία for the feast of raw flesh. Thus Acteon was a sacred stag worshipped at Plataeae

[54] Gilbert Murray, *Hamlet and Orestes,* 1914. "One of my friends has assured me that every one knew it before; another has observed that most learned men, sooner or later, go a little mad." He refers primarily to the Hamlet of Saxo Grammaticus.

[55] Farnell, *Greece and Babylon,* 26.

[56] Harrison, *Prolegomena,* 489. On the omophagia in general, 478ff.

and torn by adorers who called themselves does;[57] Hippolytus was a horse rent by horses;[58] Orpheus was a fox similarly treated by "vixens," as, quite rightly no doubt, his devotees called themselves.[59] In Orpheus the early Church justly saw a prototype of Christ.[60] It is interesting to note that the worshipers frequently, if not always, called themselves by the name of the beast or god they adored. Thus the followers of Bacchus were called Bacchi and Bacchae;[61] thus the worshipers of Jesus "put on Christ." By eating the eucharist they became ἔνθεοι ἐν Χριστῷ just as did the votaries of Dionysus.[62]

Zeus himself was sacrificed at Athens in the form of a bull. At this feast, called the buphonia, near the summer solstice, an ox was killed, eaten and restored to life in pantomime.[63] It is interesting to note that the feast—Δαὶς—became a personified divinity, just as the Roman Church, in instituting the feast of Corpus Christi day, near midsummer, has presented the mystery of the mass as an object to the adoration of the people. At Delphi also a bull, called Hosiater, or the Consecrator, and Isodaitos, "He of the equal feast," was immolated.[65] Plato doubtless had in mind one of these ceremonies when he describes[66] the killing of a bull in Atlantis, and the drinking of his blood mingled with wine. This was accompanied by an oath to deal justly, reminding us of the oath (*sacramentum*) that Pliny says the Christians took at their sacred meal.[67]

In the Eleusinian mysteries animals were immolated

[57] Reinach, C. M. R., III, 24ff.
[58] *Ibid.*, 54ff.
[59] *Ibid.*, II, 85ff.
[60] Harrison, *Prolegomena*, 474; Reinach, C. M. R., II, 83.
[61] Farnell, *Cults*, V, 150ff.
[62] Lake, *Epistles of Paul*, 214; Reinach, C. M. R., II, 105.
[63] Harrison, *Themis*, 141.
[64] *Ibid.*, 146.
[65] *Ibid.*, 155.
[66] *Ibid.*, 163; Plato, Critias, 119.
[67] Pliny, *ep.* 96.

to Demeter and their flesh eaten on the spot;[68] there was also a meal of κυκέων, a mixture of grain and water, but there is no evidence that this was regarded as representing the goddess.[69]

But of all the "mysteries" known to us, that of Dionysus bears the closest resemblance to that of Christ. The god of wine died a violent death and was brought to life again; his "passion," as the Greeks called it, and his resurrection were enacted in his sacred rites. According to the common legend the son of Zeus and his daughter Proserpina was given by jealous Hera to the Titans, who tore him to pieces, boiled his body and ate it with herbs. His heart was taken back to Zeus and Semele, from whom he was reborn.[70] As this doctrine was spiritualized his resurrection was represented in a different way and was followed by an ascension to heaven.[71] Thus was inculcated the doctrine of immortality; Plutarch consoles his wife for the death of a daughter by the belief in a future life as taught by tradition and revealed by the mysteries of Dionysus.

All this was enacted ritually in various parts of Greece. As is so often the case, the ritual preceded the legend, which was invented to explain a misunderstood custom, in this case the sacramental eating of a totemic bull,[72] or, in some cases, of a kid,[73] for the god inherited the ritual of both beasts. Thus it was celebrated at Delphi;[74] and thus in Crete. In all cases the animal was torn to pieces and a fragment of his flesh given to each worshiper and eaten raw as a sacrament, in order to impart to each some of the divine life.[75] At first this was doubtless conceived of as purely a physical benefit, but by the fourth century, B. C.,

[68] Foucart, *Les Mystères d'Eleusis*, 1914, 375f.

[69] *Ibid.*, 378ff.

[70] Frazer, *Spirits*, I, 12ff; Reinach, C. M. R., II, 58ff.

[71] Justin Martyr, *First Apology*, 54; *Dialogue with Trypho*, 69.

[72] Reinach, C. M. R., II, 58ff.

[73] *Ibid.*, 96.

[74] Harrison, *Prolegomena*, 440.

[75] Frazer, *Spirits*, II, 16.

the excellent moral effects of the initiatory feast are stressed. Thus, in a fragment of Euripides's Cretans, one speaks of "lengthening out a life of purity from the day when I became an initiate of Idæan Zeus, and a herdsman of night-roaming Zagreus [Dionysus], a celebrant of the meal of raw flesh."[76] At a later stage of Orphic theology, some offence was taken at the idea of killing a god, and the myth was changed to make the deity the sacrificer and communicant. Thus we find a god sacrificed to himself, and eating his own flesh,[77]—a striking parallel to the Last Supper and to the mass. It was not always in the interests of humanity to anthropomorphize the rite too much, for in Chios and Tenedos Dionysus was represented by a human victim who was subjected to the barbarous rite of holy cannibalism.[78]

Now all this seems to us such revolting savagery that it is hard to believe that it became imbedded in a religion of great moral purity and lofty idealism. Such, however, is the case. "The belief in the sacrifice of Dionysus himself and the purification of man by his blood," remained, according to Gilbert Murray, "a curious relic of superstition firmly imbedded in Orphism, a doctrine irrational and unintelligible, and for that reason wrapped in the deepest and most sacred mystery."[79] But the rite continued; for the wild worshipers roamed in the woods and tore to pieces and ate raw whatever animals they could cope with. "It is noteworthy, and throws much light on the spirit of Orphism, that apart from this sacramental tasting of blood, the Orphic worshiper held it an abomination to eat the flesh of animals at all. . . . It fascinated him just because it was so incredibly primitive and uncanny; because it was a mystery which transcended reason."[80] Euripides has trans-

[76] Quoted, Kennedy, *St. Paul and the Mystery Religions*, 1913, 257.

[77] Frazer, *Spirits*, I, 23.

[78] *Ibid.*, 24. [79] *Bacchae*, note on p. 85f. [80] *Ibid.*, p. 86.

muted the beastly rite into immortal poetry. He thus describes the rending of the animals:[81]

> "Great uddered kine then hadst thou seen
> Bellowing in sword-like hands that cleave and tear,
> A live steer riven in sunder, and the air
> Tossed with rent ribs of limbs of cloven tread
> And flesh upon the branches and a red
> Rain from the deep green pines. Yea, bulls of pride,
> Horns swift to rage, were fronted and aside
> Flung stumbling by those multitudinous hands
> Dragged pitilessly."

And through it all the maenads feel the divine presence, and adjure it, "O God, Beast, Mystery, come!" It is Dionysus who is the god and the bull, to whom Pentheus speaks, when he sees him, as follows:[82]

> "Is it a Wild Bull this, that walks and waits
> Before me? There are horns upon thy brow!
> What art thou, man or beast? For surely now
> The Bull is on thee!"

When the new religion was introduced into Italy, it ran a course for a time something like that of Christianity later. In the first place its votaries were accused, like the Christians, of celebrating holy meals followed by sexual debauches.[83] Later they were suppressed by the government.[84] That nothing might be wanting to make the parallel with Christianity, the word "sacrament,"[85] originally a military oath, was applied by the Romans to the initiation. Indeed it is certain that that word had the connotation of consecration long before the rise of the Roman Church or its founder. It was employed, for example, by Apuleius,

[81] *The Bacchae,* line 700ff; *ibid.,* p. 44.

[82] *Ibid.,* line 920ff, p. 55.

[83] Livy, XXXIX, 8, 5, quoted Reitzenstein, 88.

[84] E. Gibbon, *Decline and Fall of the Roman Empire,* Chap. XV. He says that the language of Tacitus in describing the introduction and attempted suppression of the Christian worship, is almost similar to that of Livy about the Bacchanalia.

[85] Livy, XXXIX, 15, 13; Reitzenstein, 66.

for the visible sign of the spiritual grace vouchsafed to the worshipers of Isis.[86]

As men became softer and more fastidious, substitutes were found for the raw flesh and blood which were originally elements of their communion. Thus the sacred ivy, regarded as an impersonation of Dionysus, was substituted for his flesh,[87] and wine for his blood.[88]

The connection of wine and blood was as familiar to antiquity as it is to us through the eucharist. It was often an offering to the gods and a means of communion with them.[89] The blood was the life; who imbibed it absorbed the spirit. A Greek word for soul, θυμός, is etymologically *fumus*, the hot "steam" from the blood.[90] The Romans sealed their oaths by drinking a mixture of wine and blood called *asseratum*.[91] Among the Hebrews, too, wine was called the "blood of the grape,"[92] Offerings of bread and wine were made to Asklepios, the god of healing.[93]

It must be remembered that this tradition of the eaten god was kept up by the mysteries among the lower strata of society only. In the world of art and letters best known to us there prevailed an enlightened skepticism. Not many wise, not many noble, were called to salvation by the blood of Bacchus or of Attis. The expressed opinion of a Roman philosopher as to the Real Presence is very much what the expressed opinion of a modern scientist is now: "When we call corn Ceres and wine Bacchus," says Cicero,[94] "we use a common figure of speech; but do you imagine that any-

[86] Apuleius, XI, 15, quoted *ibid.*

[87] Plutarch, *Quaestiones Rom.*, 112; Clemen, 258; J. Rendel Harris, "Origin of the cult of Dionysus," *Bulletin of J. Rylands Library*, 1915, p. 119ff.

[88] Justin Martyr, *First Apology*, 54; *Dialogue with Trypho*, 69.

[89] Kircher, *Die sakrale Bedeutung des Weines im Altertum*, 1910, 45.

[90] *Ibid.*, 78. [91] *Ibid.*, 83.

[92] *Ibid.*, 85. They also treated wine as blood, pouring it out at the base of altars. Robertson Smith, *Religion of the Semites*, 1894, p. 230.

[93] Kircher, 92f.

[94] *De Natura deorum*, III, 16, 41. Frazer, *Spirits*, II, 167

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body is so insane as to believe that the thing he feeds on is god?" The answer then, as now, was in the affirmative.

II. PAUL AND HIS SYMMYSTAE.

"The most excellent of the sacraments"[1] was borrowed by the Christians from the older mystery religions. That they attributed the institution of their rite to their founder was inevitable. Many of the classic myths originated as explanations of ritual, in the desire to show how Dionysus or Attis or Osiris had once done what their initiates now re-enacted.[2] The account of the Last Supper is but an etiological cult story, analogous to the Greek myths or to the Hebrew fable of the Passover in Exodus xii, designed to authorize a custom otherwise established in the earliest community.[3] "The Christ of Mark," says Loisy, "is like the gods of the mysteries; what he does is the type of what happens to his worshipers and what they must do....The idea and form of this institution were suggested....by Paul, who conceived them in a vision, on the model of the pagan mysteries."[4] In fact, as soon as any institution was established, firmly or otherwise, it was fathered on Christ, or at least on the apostles. Thus the mingling of water with wine was said by Cyprian to have begun by Jesus;[5] thus the self-communion of priests was wrongly said to have descended "as it were from apostolic tradition."[6] On the way the Gnostics attributed all their peculiar institu-

[1] So called by the Council of Trent, Mirbt, 226.

[2] Reinach, C. M. R., II, p. vi, says it is simply a matter of good faith to apply to the Gospels the same process which has been generally acknowledged as the correct solution of the classic myths. Some Christians now admit the likeness of the eucharist and the earlier theophagy. See *Catholic Encyclopædia*, and E. A. James, *Primitive Belief and Ritual*, 1917.

[3] So called by Heitmüller, R. G. G., I, 25, though illogically he tries to extract some history from the ἱερὸς λόγος. Long arguments against his position and that of Reitzenstein and Dietrich in Schweitzer, *Paulinische Forschung*, 152ff, and by G. P. von Wetter in *Z. N. T. W.*, 1913, pp. 202ff.

[4] Loisy, *L'évangile selon Marc*, 1912, 405.

[5] Quoted in *Catechism of Council of Trent.*

[6] Council of Trent, Mirbt, 228.

tions to Jesus a long and instructive essay has been written by C. Schmidt.[7]

But though we see nothing historic in the Last Supper, and are convinced that Paul founded the eucharist, it is worth while asking what analogous conceptions, if any, prevailed in the pre-Pauline community about the sacramental use of food. We shall find that there are two such conceptions plainly discernible; the first that of the Messianic feast, the second that of a spiritual nourishment. Both these are founded in the Old Testament. There, though sacrifice is a covenant with Yaweh, and a communion meal, there is no trace of the eating of a divine animal.[8] The Jews of the historic period had gone beyond this conception, just as had the "Olympian" religion of the Ionians, represented by Homer. But the idea that when the Messiah came he should eat and drink with his elect, is found in many places in the Jewish writings,[9] and doubtless considerably influenced the Christian supper. It is represented in the document known as "Q" by the marriage feast of the king's son.[10] It is also prominent in the Apocalypse,[11] though neither it nor Q nor the Jewish-Christian epistles of James or Jude or 2 Peter, know anything of the eucharist.[12] Thus also Luke makes Jesus say to his disciples: "And I assign unto you, as my Father has assigned unto me, a kingdom, that ye may eat and drink at my table in my kingdom."[13]

[7] *Texte und Untersuchungen,* VIII.

[8] H. P. Smith, *The Religion of Israel,* 1914, pp. 39f.

[9] Isaiah lv. 1ff; lxv. 12ff; xxv. 68; Enoch, xxiv and xxv; Test. Levi, xxiii. 11 and lxii. 14. Schweitzer, *Quest of the Historical Jesus,* 1910.

[10] Matt. xxii. 1-14; Luke xiv. 15-24.

[11] Apoc. ii. 7, 17; iii. 21; vii. 16f; xix.

[12] The idea that Apoc. ii. 17 refers to the eucharist is untenable. *Hibbert,* XI, 140ff. "Q" has nothing even on the Passion. Harnack, *Sayings of Jesus,* 1908, 233. W. Haupt, *Worte Jesu und Gemeinde-Ueberlieferung,* 1913.

[13] Luke xxii. 30. It is uncertain whether the original was in Q. Probably not, as Matt. lacks the verse, and the word διατίθεμαι is eucharistic.

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The other idea which amalgamated naturally with the eucharist was that of a spiritual nourishment. "Man cannot live by bread alone," says the Deuteronomist, "but by every word that proceedeth out of the mouth of God."[14] The manna was to the Psalmist "bread from heaven."[15] Isaiah offered bread and wine and milk of a spiritual nature without money and without price.[16] "Those who eat me," says Wisdom in Ecclesiasticus,[17] "will always hunger for me; those who drink me will always thirst for me again." Philo, too, spoke of the Logos as the bread from heaven.[18] Nor do I doubt that this is the meaning of the fourth petition in the Lord's Prayer: "Give us this day our supernatural [i. e., spiritual] bread." The Greek word ἐπιούσιος is translated in the Latin versions *supersubstantialis*,[19] followed by Wyclif with "bread above other substance" and the Douai Bible with "supersubstantial bread." One ancient Latin manuscript in the British Museum reads "Panem verbum Dei celestem da nobis hodie,"[20] evidently a gloss, but a good one. To express so simple an idea as "daily" the author of Q would certainly not choose a word so rare that it is not met with elsewhere, was absolutely unknown to learned Origen,[21] and puzzled early evangelists.[22] Moreover "daily" would be tautological, having just been said.[23] Further, the petition for bread would

[14] Deut. viii. 3. [15] Psalm lxxviii. 24f. [16] Isaiah lv. 1f.

[17] XXIV, 29. Many other references in Stone, *History of the Doctrine of the Holy Eucharist*, 1909, i. 3.

[18] Quoted Pfleiderer, IV, 23ff.

[19] In Matt. vi. 11. The translation of the same word in Luke xi. 3 is *quotidianus*, and this form is adopted in the ritual. Most modern versions follow this second rendering, "daily," which is also supported by F. S. Chase, *The Lord's Prayer*, 1891; F. Blass, *Grammatik des neutestamentlichen Griechisch*, fourth edition, 1913, § 123; Dobschütz, *Harvard Theological Review*, 1914, p. 313.

[20] E. S. Buchanan, ἐπιούσιος, *Expositor*, 1914, p. 423.

[21] *De oratione*, XXVII, 7.

[22] The Gospel of the Hebrews rendered "to-morrow's bread." The Acts of Thomas (Pick, *Apocryphal Acts*, 1909, 144) omitted this petition altogether. Cf. Cyril's *Catechetical Lectures*, quoted by Stone, I, 91.

[23] Matt. vi. 25; Luke xii. 22.

contradict the injunction given a little later, to take no thought for what to eat or to drink, but to seek first the kingdom. All the other petitions in this early Christian prayer are for spiritual blessings, and the intrusion of the mere bodily needs would be strange. Etymologically the word is compared by Liddell and Scott to ἐπιετανός, but it seems better to derive it from ἐπι meaning "super" and οὐσία meaning "substance," and to compare it with ἐπουράνιος, "superheavenly," in other New Testament writings.

The idea of a spiritual nourishment offered directly by God to the believer is also developed in the Johannine writings and in what was one of their principal sources, the Odes of Solomon. Written probably by a Disciple of the Baptist at Ephesus very near the middle of the first century,[24] one of these poems (XIX, 1ff) says: "A cup of milk was offered to me and I drank it in the sweetness of the delight of the Lord. The Son is the cup, and he who was milked is the Father and she who milked him is the Holy Spirit."[25] Elsewhere in these poems, which nowhere have any allusion to the eucharist,[26] milk and honey are spoken of as the mystic food of believers.[27] It is interesting to note in this connection that milk and honey were added to the first communion in the Monophysite churches of Armenia.[28] This would seem to indicate that feeding with milk was actually done as symbolic of the new and spiritual birth of the child. Sallustius[29] speaks of "feeding on milk as though we were being born again," in the ritual

[24] Preserved Smith, "The Disciples of John and the Odes of Solomon," *Monist*, 1915, pp. 161-190.

[25] Reading of Burkitt's manuscript of the Odes, *Journal of Th. Studies*, 1912.

[26] *Monist*, 186.

[27] J. Rendel Harris, *The Odes and Psalms of Solomon*, second edition, 1911, p. 80.

[28] Conybeare, "Eucharist" in *Encyclopædia Britannica*.

[29] "On the Gods," translated by G. Murray, *Greek Religion*, p. 193.

of Attis. Perhaps the same thought lies back of Paul's simile "milk for babes" (1 Cor. vi. 5). But it is plainest in the First Epistle of Peter, so called, in the words translated in our Revised Version:[30] "As newborn babes, long for the spiritual milk which is without guile." The Authorized Version in this case came nearer to the true meaning when it rendered λογικὸν ἄδολον γάλα "sincere milk of the word," provided only we write Word with a capital, and understand it of the Logos.

But neither the celestial bread nor the milk of the Logos constituted a ritual meal. It is practically certain, however, that the first Christian community had such prior to the institution of the eucharist by Paul.[31] Precedent for such could be found in Jewish custom,[32] and among the Essenes[33] and probably also in the custom of the Disciples of John.[34] This meal was known as the "love-feast," and persisted in certain quarters side by side with the eucharist for many years. It is alluded to by Jude[35] and described by Tertullian.[36] Whether any traces of it can be found in the Gospels or in Acts, colored as these are by Pauline theology, is more than doubtful.

If we read the books of the New Testament in the order in which they were written, the first account of the eucharist is found in 1 Corinthians, written from Ephesus at about Easter time, probably in the year 55. There Paul speaks of its institution in words (xi. 23ff) which, to bring

[30] 1 Peter ii. 2. On this Reitzenstein, *Mysterienreligionen*, 156, and on similar thoughts in Egyptian religions, *ibid.*, 157.

[31] Achelis, *Das Christentum in den ersten drei Jahrhunderten*, 1912, I, 172-83; II, 78ff; Carpenter, 251ff.

[32] Josephus, *Ant.*, XIV, 10, 8; S. J. Case, *The Evolution of Early Christianity*, 1914, p. 340.

[33] R. G. G. I., 38.

[34] The Mandaeans or Sabacans, the spiritual descendants of the Disciples of the Baptists, had a supper consisting of "bites and water." M. Brückner, *Der sterbende und auferstehende Gottheiland*, 1908, p. 47.

[35] Jude, 12.

[36] Tertullian, *Apology*, cap. 39.

out their literal meaning, I translate into unavoidably awkward English: "For *I* received over from the Lord that which also I delivered over to you, how that the Lord Jesus in the night in which he was delivered over, took bread, and having blessed it, broke and said: This is my body which is for you. This do in remembrance of me. In like manner also the cup after supper, saying, This cup is the new covenant in my blood. Do this, as often as you drink it, in remembrance of me. For as often as ye eat this bread and drink this cup, ye proclaim the Lord's death till he come. So that whoever eats the bread and drinks the cup of the Lord unworthily is guilty of the body and blood of the Lord. But let a man try himself and thus eat of the bread and drink of the cup. For who eats and drinks not discerning the body is eating and drinking judgment to himself. For this cause many among you are weak and sickly and not a few sleep."

It is an official dogma of the Catholic Church that these words should be taken as history.[37] The Catholics, less subjective than the Protestants, admit that Paul received a special revelation on the subject, only they say that it revealed to him exactly what really happened.[38] Modern Protestant scholars have felt the intrinsic absurdity of this and have argued that Paul could not have received a special revelation on this point, because it would not be in accordance with "the acknowledged principles of economy in the use of miracles," for Paul to receive by revelation what might have been learned by other means.[39] This old-fashioned point of view will have less weight with impartial scholars than the other argument advanced, that Paul uses the words "received" and "delivered" in his account of the death and resurrection of Jesus, which, it is commonly

[37] Syllabus of Pius X, 1907, Mirbt, p. 409.

[38] Renz, *Geschichte des Messopfer-Begriffs,* 2 vols., 1901f, I, 122.

[39] Lambert, *The Sacraments in the New Testament,* 1903.

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believed, he learned from the other apostles. But reasons have been put forward to show that here, too, Paul is really giving the results of his own subjective visions.[40] These very words, "received" and "delivered," were used in the Pirke Aboth, i. 1, of what Moses received directly from Jehovah on Sinai and delivered to the elders.[41] They were also technical terms of the pagan mysteries.[42] If we will only listen to Paul himself we shall learn whence he got his doctrine: "The gospel which was preached by me is not after man. For neither did I receive it from man, nor was I taught it, but it came to me through revelation of Jesus Christ....When it was the good pleasure of God ....to reveal his Son in me,....immediately I conferred not with flesh and blood, neither went I up to Jerusalem to them which were apostles before me: but I went up into Arabia: and again I returned unto Damascus. Then *after three years* I went up to Jerusalem to visit Cephas and tarried with him fifteen days."[43] Later, Paul was kind enough to instruct these Jewish apostles in the gospel he had received, though he dared not to do it publicly.[44] How he obtained these revelations in Paradise he tells elsewhere.[45] As he "received" the story of Christ's death and resurrection thus,[46] he was perfectly consistent in asserting "Christ was raised according to *my* gospel."[47] The whole thing was "God's wisdom in a mystery,"[48] and this mystery itself was Christ: "He who was manifested in the flesh,

[40] Preserved Smith, "A New Light on Peter and Paul," *Hibbert*, July, 1913. The conclusions here advanced have been accepted by Solomon Reinach who translated the article in French and published it in the *Bibliothèque de propagande*, Oct. 15, 1913.

[41] J. Weiss, in *Archiv für Religionswissenschaft*, 1913.

[42] Clemen, 233. [43] Galatians i. 11ff.

[44] *Ibid.*, ii. 2 [45] 2 Cor. xii. 2ff. [46] 1 Cor. xv. 4.

[47] 2 Tim. ii. 8. The pericope, according to many scholars, is Paul's, though the whole epistle is not.

[48] 1 Cor. ii. 7.

justified in the spirit, seen of angels, preached among the nations."[49]

The German Wrede has put us under a great debt by at last writing a biography of the Tarsian,[50] showing both how it was possible psychologically for Paul to evolve these myths and possible historically for him to foist them on the Christian Church. But this is not the place to discuss the whole extent of Paul's mythology; all that here concerns us is his derivation of the eucharist. *A priori,* the possibility of his dependence on the Mysteries cannot be denied.[51] It has been proved from linguistic evidence, proved to the hilt, that Paul was saturated in the current conceptions of the Mystery Religions,[52] prominent among which was that of the eaten body of the Saviour God, who, in human form, should live, suffer violent death and rise again. He himself speaks of "the table of demons," i. e., of false gods, and of "communion with demons" as analogous to the communion with Jesus (1 Cor. x. 21). Moreover, in this particular case the evidence of his derivation of his doctrine from a vision is peculiarly strong. Hardly any scholar, not under the double dogmatic prepossession of the historicity of the Last Supper and the improbability of revelations, has denied it. Among a vast number who have admitted the vision are Chrysostom, Osiander, Calvin, Gardner,[53] Conybeare[54] and Reitzenstein.[55]

In fact the force of the language is overwhelming. The

[49] 1 Tim. iii. 16. The letter is not by Paul, but well expresses the primitive Christian idea.

[50] *Paul,* English translation by J. F. Carpenter, 1908. According to Schweitzer the book belongs "not to theology but to world-literature."

[51] Heitmüller in *R. G. G.,* "Abendmahl."

[52] Reitzenstein, *Mysterienreligionen und Paulus, passim.*

[53] Gardner, *Exploratio Evangelica,* second edition, p. 453, gives references for the older scholars. He here withdraws his former theory that Paul derived the Supper from the Eleusinian Mysteries, but says that Paul was influenced by mystery concepts in general.

[54] *Myth, Magic and Morals,* 251ff.

[55] *Mysterienreligionen,* 50f.

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emphatic "I," the positive statement that the doctrine was received "from the Lord," ought to be decisive. But this is not all. Note that Paul uses the same word for that which he "delivered over" to the Corinthians, and that which was done on the night in which the Lord was "delivered over." Prof. W. B. Smith has pointed out that this could not mean "betrayed," as it is commonly rendered, but must mean "delivered up" or "surrendered."[56] This explanation has now been adopted by Messrs. A. Robertson and A. Plummer, in their Commentary on 1 Corinthians.[57] They state that the words in question refer "perhaps chiefly to the Father's surrender of the Son, and the Son's self-sacrifice may also be included." Better, possibly, to say that Jesus was himself, as a mystic concept, delivered over to Paul and by him so delivered over to his neophytes.

One more point requires exegesis before we proceed to the consideration of Paul's eucharistic doctrine in general. The words "new covenant," here used first of the cup, were probably borrowed by Paul from the Jewish Messianic sect of the Zadokites,[58] who made a "new covenant" at Damascus, shortly before Paul's sojourn there. The Greek word διαθήκη commonly means "testament," and is so used by the author of the epistle to the Hebrews.[59] But as it is the equivalent of the Hebrew *berith,* and was used to translate this word in the Septuagint,[60] "covenant" is almost certainly the true meaning of the word here.[61]

What is Paul's understanding of the words "This is my body"? It is certain that he took them literally. The "*hoc est corpus meum*" which has been decisive for the

[56] *Ecce Deus,* English edition, 1912, pp. 303ff. German edition, 1911.

[57] *International Critical Commentary,* p. 243.

[58] Fragments of a Zadokite Word, *Apocrypha and Pseudepigrapha,* ed. R. H. Charles, II, 792.

[59] Hebrews, ix. 15ff.

[60] E. g., Job xxxi. 1.

[61] Dibelius, *Das Abendmahl,* 1911, 76ff.

Catholic Church, and which, Luther declared, was "too strong" for him, meant exactly what it said. The reason why many Protestants have maintained the contrary is simply that they believed it impossible themselves. Of course it is impossible—but that does not mean that Paul did not believe it. Kirsopp Lake puts the point aptly: "Much of the controversy between Catholic and Protestant theologians has found its center in the doctrine of the eucharist, and the latter have appealed to primitive Christianity to support their views. From their point of view the appeal fails; the Catholic doctrine is much more nearly primitive than the Protestant. But the Catholic advocate in winning his case has proved still more: the doctrine which he defends is not only primitive but pre-Christian."[62] And again: "It is necessary to insist that the Catholic is much nearer to early Christianity than the Protestant."[63]

The part of the text stressed by those who wish to make the rite merely commemorative is, "Do this in remembrance of me." Let us hear an expert on the subject: "Frankly," says Reitzenstein,[64] "I can never interpret these words of a mere commemorative meal, such as the Greek cult of the dead knows. The whole sacramental teaching which Paul adds immediately, contradicts that interpretation. The words can be better understood in a mystical sense analogous to that of an approximately contemporary narrative in a magic text in which Osiris gives Isis and Horus his blood to drink in a cup of wine, in order that they may not forget his death, but must seek him in yearning plaint, until he again becomes alive and unites with them." This then explains also the words "ye proclaim the Lord's death till he come." If the eucharist be regarded as analogous to the meals held in memory of dead friends by the Greeks,

[62] Lake, *Earlier Epistles of St. Paul*, 215.

[63] *H. T. R.*, 1914, p. 429.

[64] *Mysterienreligionen*, 51.

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it must be recognized that these meals, also, were sacrificial."[65]

In the same sense must be read the words that he who eats and drinks unworthily, not discerning the body, eats and drinks judgment (or "damnation") to himself. The meaning is so clear that Mr. Scott is able to say that practically all commentators agree that the phrase refers to the failure on the part of the worshiper to see that the bread represented the body of Christ.[66] "Behind these words," says Bousset quite rightly, "we catch glimpses of definitely sacramental feeling, the belief in the marvelous virtue of sacred food, for weal or woe."[67] How perfectly crude were Paul's ideas of this magical effect is brought out in verse 30, where he attributes the prevalence of sickness and death among his converts to the misuse of the holy food. But the benefits of the Christian mysteries did not go the length of guaranteeing salvation irrespective of conduct. Paul devotes the best part of a chapter to the confutation of this belief which had evidently gained currency among the Corinthians.[68] Indeed some of them turned their eucharists into drunken orgies.[69] Whether the abominable sexual disorders among them[70] originated in these debauches, cannot be told. Somewhat later the accusations were made against the Christians that they united "Thyestean banquets and Oedipean intercourse" at their meetings.[71]

Almost all that Paul says implies his belief that bread and wine were body and blood of Christ. Thus (1 Cor. x. 16): "The cup of blessing which we bless, is it not a sharing

[65] Lake, *Earlier Epistles*, 214.

[66] *Expositor*, August, 1915, 182ff. He himself, however, proposes that the body here means "fellowship," and "failing to discern it" means being unbrotherly.

[67] *Die Schriften des Neuen Testaments*, 1906f, ed. J. Weiss, *ad. loc.*

[68] 1 Cor. x; Lake, *Earlier Epistles*, 200 and 213.

[69] 1 Cor. xi. 21. [70] 1 Cor. v.

[71] *R. G. G.*, I, 633. "Nachapostolisches Zeitalter" by Knopf.

of the blood of Christ? The bread which be break, is it not a sharing of the body of Christ?"[72] If we ask *how* he conceived this, the answer must be that he never raised the question of mode, but that he appears to have assumed the reality of his contention with a literalness far surpassing that of the Fourth Lateran Council. In classical antiquity symbol and reality were not separated as we separate them.[73] To Greek philosophy words were things, and that was its greatest weakness. So the personification of bread, wine, war and love as Ceres, Bacchus, Mars and Venus seems to us mere figure of speech, but to the ancients implied a good deal more. Even so a child will now say of her doll "This is my baby," and if you insist that it is not her baby, but only the symbol of one, will not be convinced, and will even begin to cry if you press the point. So to the primitive Christian the bread and wine simply *were* the body and blood of his Saviour; words could not make it plainer to him than that. They just *were*.

This belief of Paul implies the other one held by the Catholic Church that the eucharist is a sacrifice. He never states this with equal clearness, but he assumes it. Indeed it could hardly be otherwise. It is probable *a priori* because it was so in the mystery religions he knew. It is probably *a posteriori* because it can be proved that other Christians of the first century, e. g., Clement of Rome, so regarded it. But it is not entirely a matter of inference. Conybeare correctly points out that the germ of the idea, at least, is found in the words, "body, *which is for you*," and (in the Gospels), "blood, *poured out for you*."[74] Thus Paul also speaks in one breath of "keeping the feast" and of "Christ

[72] Lake's translation.

[73] Bergh van Eysinga, *Radical Views about the New Testament*, 1912, 104. Ramsay in *Expository Times*, XXI, 516. Harnack makes the same remark. "At that time 'symbol' denoted a thing which, in some way, really is what it signifies." *Dogma*, Eng., II, 144. Cf. also IV, 289, n. 2, and Loofs in Real-encyclopädie für protestantische Theologie und Kirche, 3d ed., I, 58.

[74] Conybeare, "Eucharist," E. B.

our passover that hath been sacrificed for us."[75] Thus, further, he compares the holy bread with the sacrifices of Israel, which gave the Jews "communion with the altar,"[76] and with the things which the heathen sacrificed to devils: "Ye cannot," says he, "partake of the cup of the Lord and the cup of devils; ye cannot partake of the table of the Lord and the table of devils."[77] In this verse, which incidentally furnishes invaluable proof that Paul was familiar with the sacrificial meals of the pagan mysteries, the Catholics rightly see a clear support to their doctrine of the sacrifice of the mass.[78] The idea here is the same as that expressed in the Pseudo-Clementine Recognitions, that he who worships pagan gods, or tastes meat sacrificed to them has communion with demons.[79] Further the words "This *do* in remembrance of me" had the connotation in both Greek and Latin (ποιεῖτε, *facite*) of "doing sacrifice."[80]

Indeed it was inevitable that the communions should be regarded as the counterpart of sacrifices, both Jewish and pagan.[81] And in the later developments of both religions, Paul would find prepared for him the idea of "spiritual and bloodless sacrifices," a phrase soon borrowed to denote the eucharist. According to the Testament of the Twelve Patriarchs the angels offer such sacrifices to God.[82] In the Hermetic literature the same phrase λογικὴ θυσία is applied to the offering brought by Tat to his father Hermes.[83] The victim here thought of was the

[75] 1 Cor. v. 7.

[76] 1 Cor. x. 17f.

[77] I Cor. x. 21. Srawley, in *Encyclopædia of Religion and Ethics*, V, 544.

[78] Council of Trent, Mirbt, 242.

[79] II, 71. Kennedy, 273.

[80] Conybeare in E. B., "Eucharist." Renz, I, 152. Cajetan, quoted below; Stone I, 9. The same double meaning is in Hebrew עשה.

[81] Conybeare, *Myths, Morals and Magic*, 252.

[82] Test. Levi, III, 6.

[83] *Corpus Hermeticum*, XIII. 18; Reitzenstein, *Mysterienreligionen*, 35, 88.

Logos,[84] just as in similar words about Isis the victim offered to the goddess was herself.[85] And this victim was represented by the body of the worshiper, a comparison also made by Livy in describing the Bacchanalia.[86] All this serves to illuminate Paul's injunction to the Romans (xii. 1) to present their bodies to God as a spiritual service. The allusion is not directly to the eucharist but is from a circle of ideas closely analogous to that of the sacrifice of the communion. It is expressed more clearly in 1 Peter ii. 5.

Other passages in the Pauline epistles[87] doubtless have the eucharistic doctrine as a background, but they are too vague, apart from one in Colossians, to be discussed presently, to be of importance for our present purpose.

It will be objected that if Paul really introduced a new and pagan rite into Christianity, it would have been withstood violently by the Jewish Christians and especially by the previous apostles.[88] To this the answer is that he really was so opposed and on this very point. Since F. C. Baur,[89] few church historians have realized the tremendous strain that existed between the Jerusalem community and the Apostle of the Gentiles. It became so virulent that when Mark wrote his gospel, entirely along Pauline lines,[90] he could find scarcely anything to say about Peter save that

[84] *Ibid.*

[85] *Ibid.*, p. 91.

[86] Livy, XXXIX, 10, 7; Reitzenstein, p. 88.

[87] 1 Cor. xii. 13; Galatians iii. 6-26; Romans iv. 25 to v. 9; Eph. ii. On these see B. W. Bacon in *Harvard Theological Review*, 1915, 505ff. He finds not only the Pauline epistles but the Gospels "polarized" about the two sacraments of baptism and the supper.

[88] Schweitzer, *Paulinische Forschung, Einleitung.*

[89] *Paul*, English translation, 1876, Introduction and Part I, *passim*. On this, Schweitzer, *Paulinische Forschung*, 10 and 194. Cf. further, *Hibbert*, 1913, 737ff.

[90] On Mark's Paulinism, Loisy, *Les évangiles synoptiques*, I, 25, 116; B. W. Bacon, *The Beginnings of the Gospel Story*, 1909, pp. xxvff. Harnack, *Sayings of Jesus*, 248. The theory, originating with Papias, that Mark represents Peter, has been exploded.

he had denied his Lord and that Christ had called him Satan.[91] When, on the other hand, the Jewish faction expressed itself, it was to brand Paul as "a false apostle and a liar,"[92] and, "Balaam, who taught the children of Israel to eat things sacrificed to idols and to commit fornication."[93] Not only the Jews but the disciples of John at Ephesus and Damascus anathematized him as the perverter of their law, "the man of scoffing."[94] That the great schism in the early Church does not occupy a still more important place in the New Testament is due partly to the fact that Peter and Paul apparently divided the field into two spheres of influence, the Jerusalem apostles agreeing, for the sake of a tribute, to allow Paul to preach what he wished to the Gentiles.[95] It is also due in part to the complete triumph, after the destruction of Jerusalem, of the Pauline faction and to the desire of irenic historians like Luke to smooth everything over and make all appear according to Paul's gospel from the beginning.[96]

As to the eucharist, though there was opposition, its adoption was made easier to the Jewish Christians by the fact that they already had a common meal with which it was soon identified. This "love-feast," as we know from Jude, Tertullian and other sources, continued to the second century at least.[97] The difference of opinion among scholars as to whether it was identical with or different from the eucharist, is doubtless due to the fact that the two, at

[91] Mark viii. 31-34; xiv. 66-72.

[92] Apocalypse ii. 2; the allusion to Paul has been recognized by Renan and many others.

[93] Apocalypse ii. 14. The reference is to the doctrine of 1 Cor. x. Spiritual fornication, or idolatry, is meant.

[94] In the recently discovered *Fragments of a Zadokite Work*, cf. G. Margoliouth in *Expositor*, Dec. 1911 and March 1912.

[95] Galatians ii. 7. Conybeare, *Myth, Magic and Morals*, 11. *Hibbert*, 1913, pp. 748ff.

[96] *Hibbert*, 757. Harnack, *Luke the Physician*, 158f.

[97] Conybeare, "Agape" in *Encyclopædia Brit.*

first distinct, were gradually merged. It is noteworthy that the purely Jewish Christian literature, so far as it has survived in the New Testament—namely Q, James, Jude, 2 Peter and the Apocalypse—says nothing of the great rite of the Gentile Church. Nor—and this is very significant[98]—does the Shepherd of Hermas, one of the earliest Roman Christian writings. Little later the Didache,[99] in giving an account of the eucharist, carefully refrains from speaking of the Last Supper, of the body or blood or of the sacrifice of the cross. Instead of the words of institution, he recommends a simple prayer connecting the cup with the "vine of David."

A somewhat stronger opposition is probably seen in the Epistle to the Hebrews. O. Holtzmann has recently pointed out in this book a polemic against the eucharist.[100] Other scholars[101] have seen reference to the eucharist without polemic, and still others[102] have denied that there are any references at all. The verses which Holtzmann relies on are xiii. 9f: "Be not carried away by diverse and strange teachings: for it is good that the heart be stablished by grace, not by foods wherein they that occupied themselves were not profited. We have an altar of which they have no right to eat which serve the tabernacle." This seems to agree well with the interpretation of Holtzmann, and it is on the whole supported by other verses in the epistle. Thus in vi. 2, the writer speaks of baptism and laying on of hands but omits the eucharist. More striking is ix. 9: "gifts and sacrifices which cannot, as touching the conscience, make the worshiper perfect, being only, with meats and drinks and divers washings, carnal ordinances." The reference is,

[98] Réville, *Révue de l'histoire des religions,* LVI, 26.

[99] IX, 10; Gardner, *Exploratio Evan.,* 458; *Religious Experience of Paul,* 119, etc.

[100] *Z. N. T. W.,* 1909, 251-60, against him, Goguel, 219.

[101] Srawley, *E. R. E.,* V, 543. [102] Lambert, 391.

of course, to the old dispensation, but through it the author seems to hit at the new ceremonialism. Again, the insistence in x, 12 that Jesus was sacrificed once only for our sins seems to read almost like a Protestant polemic against the repeated sacrifice of the mass. The Paulinists also seem to be scored in the verse against those who have counted the blood of the covenant a common thing (xii. 29). The verse "forget not to do good and to communicate," refers, naturally, not to communion but to giving to the poor, as in Romans xv. 26, 2 Cor. ix. 13.

One other passage in Paul has been left for discussion until now, because it seems to refer to those who oppose his eucharist doctrine. I mean Col. ii. 16f: "Let no man therefore judge you in food or in drink, or in respect to a feast day or a new moon or a sabbath day: which are but a shadow of things to come; but the body is Christ's."

The Synoptic gospels adopt the Pauline view entire. I will spare my reader the exhibition of the texts relating to the Last Supper in parallel columns, and the long comparison of them, with the purpose of discovering what is historic or original in them. All such attempts have definitely failed. Those who favor Mark and those who prefer Luke,[103] cannot show that there is anything but Paul in the lesson of the narratives. The words attributed to Jesus, are, says Loisy, "the doctrine of Paul and are simply incomprehensible as addressed by Jesus to his disciples on the day of his death."[104] Mark did not need to copy them from 1 Corinthians, for the usage had become established at Rome when he wrote. His omission of the Pauline words "Do this in remembrance of me" has no significance, for they seemed to Mark implied, or, as Germans would say, *selbstverständlich*. Schweitzer and others have seen in the verse added by Mark, in which Jesus says that he will

[103] As Heitmüller, and Bacon, *H. T. R.* V, 322ff.

[104] *L'évangile selon Marc*, 403.

no more drink of the fruit of the vine until he shall drink it new in the kingdom of God, a genuine reminiscence. This, however, is untenable; for the idea here is also Pauline, closely similar to that of 1 Cor. xi. 26.

There are at least three other allusions to the eucharist in Mark besides the account of its institution. The first of these of which I shall speak is positive proof that words about the sacrament could be attributed to Jesus, though he could not possibly have spoken them. When the sons of Zebedee ask for the chief places in Christ's kingdom, he replies (x. 38). "Can ye drink of the cup that I drink of and be baptized with the baptism that I am baptized with?" This joining of the cup and baptism is surely a figurative allusion to the two Christian sacraments. But as the content of the pericope is a prophecy of the death of James and John, a *vaticinium ex eventu* certainly not genuine, the allusion to the eucharist placed in Jesus's mouth is certainly later than his time.

From the earliest days it has been recognized that the miraculous feeding of the multitudes is a symbol of the spiritual nourishment of mankind by the communion bread. John, the first commentator on the synoptics, so took it, and joins on to it his version of the sacramental words attributed to Christ.[105] How carefully the symbolism is carried out is shown in one narrative of Mark by the seating of the people in groups, as was done in the early Church, and his other narrative by the instructions to pick up the fragments. This may be compared with the miraculous instructions given by Tertullian,[106] and followed in the Roman Church to-day, to let none of the precious body of the Lord be left on the floor, if dropped.

The use of fish in connection with the eucharist at Rome

[105] Loisy, *L'évangile selon Marc*, 191ff; 225ff, to Mark vi. 32ff and viii. 1ff. Cf. John vi.

[106] *De corona mil.*, 3.

where Mark wrote has been noticed above. The reason for his repetition of substantially the same miracle is probably to be found in his use of sources, though it has been conjectured that he wished to symbolize the callings of the Jews and Gentiles respectively.

Matthew and Luke add nothing on this subject to Q and Mark. In Luke, however, we have an interesting textual problem on which I believe I can throw light. Some manuscripts,[107] headed by D, omit the words (xxii. 19b-20): "given for you. Do this in remembrance of me. And in like manner the cup, after supper, saying, This cup is the covenant in my blood, which is poured out for you." The textual evidence together with "the suspicious resemblance of this passage to 1 Corinthians" led Westcott and Hort to bracket it as an interpolation. The words are evidently taken from Paul, but as it is just as possible that Luke borrowed them as that his copyist did, and as they are present in most of the decisive authorities, they are retained by Von Soden and regarded as genuine by Jülicher, Cremer, Clemen, Schweitzer, Lambert and others.[108] If, then, they were in the original, why does the Codex Bezae (D) omit them? The answer is this: The reviser of D (or rather, probably the scribe of an earlier manuscript he copies), was from Asia Minor,[109] probably from Ephesus, at which place there was the strongest opposition both to Paul and to his eucharistic doctrine. The Disciples of John there, as is proved by the Odes of Solomon[110] and the Johannine writings, presently to be discussed, refused to take the eucharist bread or to recognize it as the flesh of Christ. Even as late as the second cen-

[107] Besides D, the old African and Italic Latin versions omit them, and Tatian changes the order of words.

[108] Lambert, 245.

[109] Ramsay, *Church in the Roman Empire*, 151ff.

[110] Preserved Smith, "The Odes of Solomon and the Disciples of John," *Monist*, April 1915, pp. 186f.

tury the Docetae of Asia Minor, probably an offshoot of the Johannites, took the same position.[111] Now the reviser of the manuscript represented by D and the Latins did not dare to omit the story of the institution as a whole, but he did delete the words implying a sacrifice and the command to repeat. Like the Fourth Evangelist later he hoped thus to keep the spiritual lesson and to avoid the ritual repetition.

Acts occasionally mentions the celebration of the Supper (ii. 42; xx. 7), but as it adds nothing to our knowledge, save to show that it and Paul's interpretation of it were thoroughly established in the community and at the late date at which Luke wrote, the book need not be further noticed.

Of the New Testament writings there remain to be discussed only the Gospel and First Epistle of John. On their teaching the most extraordinary diversity of opinion has prevailed. Some scholars have denied that the Gospel refers to the eucharist at all. Others have seen in it only an intensification and emphasis on the sacramental theory of Paul. Many think that John "spiritualizes" Paul's teaching, though without saying definitely how. The data are these: (1) John omits the account of the Last Supper and substiutes for it foot-washing, with a probable allusion to baptism. (2) In the sixth chapter he joins to the narrative of the miraculous feeding a long discourse of Jesus on the necessity of eating his flesh and drinking his blood: "I am the bread of life. He who cometh unto me shall never hunger and he who believeth on me shall never thirst." "I am the living bread coming down from heaven. If any one eat of this bread he shall live forever. For the bread which I shall give him is my flesh which is for the life of the world. Then the Jews contended with one another saying, How can this man

[111] Ignatius *ad Smyrn.*, 6.

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give us his flesh to eat? Then said Jesus to them, Verily, verily I say unto you, if ye eat not the flesh of the Son of man and drink not his blood, ye have not life in yourselves. The feeder on my flesh and the drinker of my blood hath life eternal, and I shall raise him up at the last day. For my flesh is true nourishment and my blood is true drink. The feeder on my flesh and the drinker of my blood remaineth in me and I in him."

Knowing the methods of the Fourth Evangelist, his total independence of historical tradition and his custom of writing into the narrative the lessons he thought needed in his own day, it is easy to see in this debate, nowhere recorded in the Synoptics, the controversy actually in process at Ephesus, between the Pauline Christians on one side and the Jewish and Baptist parties in the Church on the other. (3) It is possible that there is some allusion to the eucharist in the story of the wedding at Cana, but, if so, it is vague and not to our purpose.[112] The water and the blood issuing from Jesus's side at the passion have been interpreted as referring to the two sacraments. It is quite possible that the parable of the true vine (John xv. 1ff) situated as it is in Jesus's last discourse to the disciples, is an allusion to the eucharist cup, suggested by Mark xiv. 25. It is noteworthy that the prayer of consecration in the Didache connects the cup with the vine of David.

How shall we interpret these seemingly conflicting data? Why did John refuse to regard the Last Supper as historical, while embodying the doctrine of the flesh and blood of Jesus in such strong language? Did he omit the Last Supper simply as he omitted the baptism of Jesus and as he says that the master baptized not, but his disciples, as though his Christ were superior to sacramental

[112] John ii. 1ff. His sources were Mark ii. 18-22;Matt. xxii. 1-14; Luke xiv. 15-24, and IV Ezra X. Similar tales were told of Dionysus turning water into wine at his epiphany. This pericope was in ancient rituals a lesson for Epiphany. Bacon, *H. T. R.*, 1915, p. 115.

acts?[113] Surely not. His Jesus, who weeps and suffers hunger and washes his disciples' feet, is not above eating with them a ritual meal. Or does he transpose the institution of the eucharist to the earlier account of the feeding of the multitudes to show that Jesus's eating with his disciples was no new thing at his death, but that his every meal with them was consecrated? This view[114] also seems insufficient, and at variance with certain verses in the discourse quoted above (John vi).

The solution of the enigma, I am persuaded, will be found in the situation at Ephesus where the evangelist wrote. There, as we know (Acts xviii. 19ff) was a church founded by Paul, in which, naturally, the eucharist would be celebrated. But there was also a powerful element in the church drawn from the Disciples of John,[115] who had no eucharist, and who would doubtless oppose it, just as the Bohemian Brethren absorbed into Protestantism for long kept their own distinctive tenets. But we have already proved from Hebrews, from Colossians and from the D recension of Luke xxii, that there was opposition to the eucharist, and especially at Ephesus. Now, though the sources of the Fourth Gospel are many—the Synoptics, the Apocalypse, Philo, the Hermetic literature, and of course the Jewish scriptures—the ones from which he drew most heavily for his doctrine were the Pauline epistles and Odes of Solomon,[116] these latter written at Ephesus by the Disciples of John, and consequently full of allusions to baptism, but with none to the eucharist. Unhampered as he was by any trace of independent tradition,[117] he felt

[113] John iv. 2. Schweitzer advances this view, *Paulinische Forschung*, 157ff.

[114] Bacon, 434f, maintains it.

[115] Acts, xix. 1ff. That the Disciples would have no eucharist is obvious and is also proved by the Odes of Solomon. *Monist*, April, 1915, p. 186f.

[116] So Harnack and Rendel Harris. *Monist*, 1915, pp. 171ff.

[117] This fact, still disputed, has been pretty well established by Loisy, Bacon and others.

free to deal with the facts as he liked. As a follower of Paul he wished to preserve and emphasize the great spiritual lesson which he found in the words about eating the flesh and drinking the blood of Jesus. On the other hand he could not ignore the Disciples of John and their heirs, supported as they were by Jewish Christians, who abominated the supper as a heathen rite. Whether the evangelist had once himself been a disciple of the Baptist remains uncertain,[118] but that he did write with them constantly in his eye has long been recognized.[119] He therefore rejected the founding of the eucharist, and substituted for it a washing reminiscent of the one sacrament universally accepted, while at the same time conserving the lesson that Jesus is the bread of life. Not without reason does his language hark back to the Jewish Scriptures, to the Apocrypha and to Philo,[120] in showing that the Logos is the true nourishment of the soul. "Except ye eat the flesh of the Son of man and drink his blood," says he, "ye have no life in you." By this he would not have understood in the old, literal way: "It is the spirit that quickeneth; the flesh profiteth nothing. The words that I speak unto you, they are spirit and they are life" (John vi 63).

How then shall we explain the emphasis on the "water and the blood," i. e., the sacraments of baptism and the eucharist, in John xix. 34 and 1 John v. 6? It has been proposed to regard the "blood" here simply as an allusion to the passion. It is probable that the Docetae,[121] at whom these verses may have been aimed, denied the passion, and it has been shown that it would be most appropriate to connect the blood of martyrdom with the water of baptism,

[118] Gardner, *Ephesian Gospel*, 87f.

[119] Baldensperger, *Der Prolog zum vierten Evangelium*, 1897; Dibelius, *Johannes der Täufer*, 1911; B. W. Bacon, *Fourth Gospel*, 290.

[120] Psalm lxxviii. 4; Ecclesiasticus xxiv. 29; Pfleiderer, *Primitive Christianity*, 1906ff, IV, 231ff. Probably also to the supersubstantial bread of the Lord's prayer.

[121] This explanation offered by Bacon.

for the one might well follow the other.[122] Such an explanation would obviate all difficulties, but I am inclined, nevertheless, to see at least a secondary allusion to the eucharist in the "blood." If this is true, there is certainly a contrast to the teaching of the earlier chapters of the gospel. It can be instantly seen by comparing John iii. 5 with 1 John v. 6. The first passage reads: "Except a man be born by water and the spirit, he cannot enter the kingdom of God." The second: "This is he that cometh by water and blood and spirit, Jesus Christ. . . . Because these three are witnesses, the spirit and the water and the blood." In the first chapter of the gospel, then, the spirit and baptism were all that was necessary, but in the epistle and in the later, probably subsequently added, verse in the gospel, the eucharist is joined with them as one of the means of salvation. Though I am no friend of the hypothesis of interpolation, by which many wild theories have been proved, I have unusually strong reason for claiming that this verse is subsequently added. Bacon,[123] among other authorities, recognizes that the whole of chapter xxi, and that John xix. 35 are added by a later editor. The evidence for the last verse is overwhelming; it reads: "And he that hath seen hath borne witness, and his witness is true, and that man knoweth he speaketh the truth that ye may believe." The introduction without antecedent of "that man," ἐκεῖνος, *ille,* would be simply incomprehensible in the original narrative. The word points to the author of the gospel as seen by some one else. The solemn asseveration, as to a new and disputed fact, also strongly indicates editorial revision. Now it is absurd to regard the asseveration, and that alone, as interpolated. Something else must have been introduced with it, something

[122] So R. Winterbotham in *Expositor,* 1911, 62ff, and J. Denney, *ibid.,* 1908, 416ff. The latter regards the "blood" as referring primarily to the passion and martyrdom, secondarily to the eucharist.

[123] P. 191.

to which the asseveration applies, and this can only be the previous verse about the water and the blood. This, then, was added by the editor, who introduced it from the epistle. If we regard the gospel and epistle as by the same hand, we are then reduced to the necessity of reconciling the omission of the eucharist in one to its recognition in the other document. The true explanation has been suggested by Percy Gardner:[124] "In old age, when he wrote the epistle, the Evangelist seems to have relied, as was natural to a man of failing powers, somewhat more on the visible rites of the Church." It is remarkable that we find exactly such a change in Luther's dogma, and that completed in ten short years. In 1520 he put the essence (*res*) of the sacrament in the Word, and stated that the actual rite was not necessary to salvation; in 1530 he was ready to affirm that the real essence (*res*) of the sacrament was in the elements, and that participation in them was absolutely indispensable to secure their benefits. So with the Evangelist; in his younger years the spiritual lesson was all important; later, as the rite became more firmly established and as he became more ecclesiastical, he accepted the communion as essential.

Most of the Gnostic sects known to us adopted the eucharist, with its ideas of immolation and theophagy.[125] Many of their dogmas were probably founded directly on mystery cults with which they were connected in pre-Christian times. How easily pagan ideas amalgamated with Christian is seen in the eucharistic prayer in the Acts of Thomas:[126] "Come, communion of the male. . . . Come, thou that disclosest secrets and makest manifest the mysteries. . . . Come and communicate with us in thy eucharist."

[124] *Ephesian Gospel*, 213.

[125] A good account of their dogmas in W. M. Groton, pp. 35ff.

[126] Chaps. xlix and l; Pick, *Apocryphal Acts*, 268f.

Here emerge the two primitive conceptions of the mysteries and of communion with the divine after the manner of sex.

Clement of Rome in the first century calls the communion an offering and a sacrifice.[127] By making it the "liturgy" *par excellence* of the Church, he puts it in the place of the highest form of divine worship which it has ever since held in the Roman Church.

Ignatius also thinks of it as a sacrifice, and as charged with a magical quality for keeping both body and soul deathless. "The bread," says he, "is the medicine of immortality, the antidote preserving us that we should not die, but live for ever in Jesus Christ."[128] This is but a literal interpretation of John's teaching by a younger contemporary. Ignatius also states plainly that the body is the same as that which suffered on the cross.[129]

According to Justin Martyr, "God, anticipating all the sacrifices offered in his name by the command of Jesus Christ, namely the eucharist of the bread and the cup, which are offered by Christians in all places throughout the world, testified that they are well-pleasing unto him."[130] He also speaks of the eucharist as becoming the body and blood of Christ through the prayer of the Logos. To him also it is a memorial of the passion and a magical charm for giving men immortality. His comparison of this sacrament with that of Mithra has already been mentioned. In this connection it is interesting to note that with him and quite a number of other early Christians, the elements were not bread and wine but bread and water.[131] Paul speaks only of the "cup," without denoting

[127] Ad Cor. 40, 44; cf. 36. Srawley, *Encyclopædia of Religion and Ethics*, V, 546; *Encyclopædia Britannica*, IX, 868; Goguel, 224; Lambert, 412.

[128] *Ad Eph.*, 20. Srawley, 546.

[129] *Ad. Smyr.*, 6; cf. *Ad Rom.*, 7.

[130] *Dialogue with Trypho*, 117. *First Apology*, 66, 67. Srawley, 547; Lambert 415.

[131] Harnack, *Brot und Wasser. T. & U.*, VII, 2, 1891.

its contents, but both he and the gospels imply that it was wine.[132]

It was the insistence on the element of sacrifice that gave rise to the rumors in the Roman world of "Thyestean banquets." Early in the second century Pliny[133] felt it necessary to inform Trajan that the meal partaken of by the Christians was of harmless and ordinary food, and that he found nothing criminal in it but only a perverse and excessive superstition. In the same letter he uses the word *sacramentum* of the morning service, but does not connect it with the supper which was eaten later in the day. The word, which we have seen was already used of the rites of Bacchus and Isis, became the regular translation of the Greek "mysterium," the initiation into holy secrets and magical practices characteristic of all the "mystery-religions," including Christianity. The word is found in the Septuagint only in the latest books, Daniel and the Apocrypha, when the Hellenization of the Jews was well under way.

Though Clement of Alexandria does not emphasize the sacrificial aspect of the eucharist, he is familiar with the conception of sacrifice as originally a feast upon a victim, and neither the idea of the Real Presence nor that of transubstantiation are foreign to his thought.[134]

Irenaeus call the bread and wine an offering to God the Father of the body and blood of his Son, and says that it is efficacious for the body as well as for the soul. When consecrated, the bread is no longer bread but of two elements, a heavenly and an earthly, and prepares our bodies for the resurrection. He compares it to the sacrifices of the Jews to its advantage, as being offered by children, not servants.[135]

[132] 1 Cor. xi. 21; Mark xiv. 25 etc. [133] Ep., 96.

[134] Tollington, *Clement of Alexandria*, 1914, II, 155.

[135] *Adv. Haer.*, IV. xviii, 4. *De corpore et sanguine*, V, ii, 2. Srawley, 547.

As has been shown, the fundamental idea in eating the God was to become like him. This was carried so far in the pagan religions, that the initiates not only imitated what the god was fabled to have done, but were actually called by his name. The adorer of Bacchus became a Bacchus; the follower of Attis was called Attis.[136] This dogma could not be better expressed than it was by Cyril of Jerusalem, who, in his Fourth Mystagogic Catechism teaches: "By taking the body and blood of Christ, you become one body and one blood with him. For thus we become Christ-bearers (χριστοφόροι) by his body and blood being digested into our members."[137] The language of ritual again became the mother of legend, and the myth of St. Christopher was born.

The "highest" doctrine of the sacrifice of the commuion is found in Cyprian near the middle of the third century. "The priest," says he, "imitates what Christ did, and offers then in the Church to God the Father a true and complete sacrifice,"[138] and again: "The passion of the Lord is the sacrifice we offer."[139]

Cyprian's idea of the effect of the magic food was that of the savage medicine-man. He tells in one place of a little girl who had eaten some meat sacrificed to idols and thus became possessed by devils. When she came to the Lord's table, she accordingly refused the consecrated cup and fell into fits.[140] A similar magical effect is attributed to the host by the Acts of Thomas.[141] A youth who had murdered his mistress partook of the eucharist and immediately had his hand withered. The Apostle forthwith invited him to confess his crime, "for," said he, "the

[136] As in Catullus's famous poem of that name.
[137] Quoted, Dietrich, 107.
[138] Ep. LXVIII, 14. Mirbt, 24b.
[139] *Ibid.*, 17.
[140] *De lapsis*, cap. 25. Dietrich, 107.
[141] Cap. XLVIII.

eucharist of the Lord hath convicted thee." It is well to bear in mind that the magic of the host is not a medieval invention but as primitive as the rite itself.

The Didascalia, in the second half of the third century, speaks of "offering the acceptable eucharist, which is the symbol (ἀντίτυπον) of the royal body of Christ."[142]

In the next age the Apostolic Constitutions call the bread and wine "symbols (ἀντίτυπα) of his precious body and blood" and an "unbloody sacrifice," celebrated to commemorate the Lord's death.[142]

Eusebius of Caesarea says that Christians are "fed with the body of the Saviour," and that Christ delivered to his disciples the symbols of his divine incarnation, charging them to make the image of his own body.[143] (Are we listening to the priest of Aricia and his image of the Wood-King baked in bread?) Here and elsewhere the words for image (εἴκων, *figura*), imply the real presence.

Tertullian's fetishism made him dread any disrespect offered to the magic food. He speaks of "handling the Lord's body" and of "offering violence to it." The bread he also calls the "figure of the body," and "that which represents the body," without, however, implying that the body is absent. Rather than saying that he began to confound the bread with the body, it is truer to see in him the first to distinguish them.[144]

In many writers of the period of Rome's decline and fall the sacrificial idea comes to dominate all others. Strange, this fascination of blood, that *ganz besonderer Saft,* for the savage and religious mind! Only by some horrible cruelty and suffering inflicted, generally against their wills, on others, can man escape from the bogies of his own conscience! Like other Christian doctrines, that of the

[142] Srawley, *E. R. E.*, v. 549.

[143] *De Solemnitate Pasch.*, 7.

[144] Srawley, *E. R. E.*, v. 549.

atonement is rooted in the primeval practice of the savage in cursing some senseless object, or killing some harmless animal or innocent person, in order to get rid of his own sins on vicarious shoulders.[145] Some such idea haunted the mind of Athenagoras when he speaks of "the bloodless sacrifice of the Christians," as the counterpart of the bloody sacrifice of the cross. Thus does Cyril of Jerusalem dilate upon the "holy and most awful sacrifice," "Christ immolated for our sins to propitiate God who loves men," offered in the eucharist. Thus Chrysostom gloats over "the Lord lying slain, and the priest standing over the victim praying, all reddened with that blood."[146]

Before closing this section on the primitive Church, it is pertinent to notice one question which early came up, as to the ministration of women in the eucharist. From the first, women had taken a part in divine service and had prophesied with the men. Such were the daughters of Philip the Evangelist, from whom, according to Harnack,[147] Luke derived much of his peculiar material. But St. Paul, who commonly lent his influence to the worst social oppressions of the age,[148] in this also advocated the subjection of women,[149] thus adding to the burden of that much suffering sex. As, however, the practice continued here and there, we meet with later efforts to deal with it. The most interesting of these is in the Apostolic Church Order.[150] It is but one instance of many to show the inveterate tendency of men to refer back to authority, and, if there is not a command of God covering the subject they desire to deal with, to invent one. Just as Paul

[145] J. G. Frazer, *The Scapegoat.*

[146] *De Sacerdot.*, VI, 4; Srawley, *E. R. E.*, 551f.

[147] *Luke the Physician.*

[148] E. g., passive resistance to tyranny, Romans xiii. 1ff, and slavery, 1 Cor. vii. 20f.

[149] 1 Cor. xiv. 34ff; cf. 1 Tim. ii. 12.

[150] Bauer, *Das Leben Jesu im Zeitalter der neutestamentlichen Apocryphen*, 1909, 165. Pick, *Paralipomena*, 68b.

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fabled that Christ had instituted the Supper, so the later author felt free to write history as follows: "The Apostle John said: 'You have forgotten, brethren, that when the master demanded the cup and the bread and consecrated them with the words, That is my body and blood, he did not allow them [*sc.* Mary and Martha] to come to us.' Martha said, 'It was on account of Mary, for he saw her smile.' Mary said: 'I did not laugh; it is rather as he said to us before that weakness should be saved by strength.' "[151]

This obvious invention did not entirely suppress the abuse at which it was aimed, or else the practice cropped up afresh from time to time. The service of women at the altar was condemned by a council of Nimes in 394, but still persisted in certain parts of France. In the sixth century in Brittany women called "conhospites" offered the blood of Christ to the people and carried the elements around on portable altars. This "unheard-of superstition" was denounced and suppressed by the bishops Licinius of Tours and Melaine of Rennes. It is continued elsewhere, however, until the ninth century.[152] It is profitable to compare with this the service of maidens at the grail, an ancient vegetable sacrifice which finally became identified with the eucharist.[153]

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[151] I. e., woman by man.

[152] *Monumenta Germ. Hist., Leges,* I, cap. 2, p. 42. I owe this reference to Miss R. J. Peebles. Other examples of women who dispensed the eucharist in the early Church or in heretical sects given in article *"Frauenämter,"* in *R. G. G.*; Lydia Stöcker, *Die Frau in der alten Kirche,* 1907; L. Zscharnack, *Der Dienst der Frau in den ersten Jahrhunderten der christlichen Kirche,* Göttingen, 1902.

[153] Peebles, *The Legend of Longinus,* 1911, 209.

MIND, THE CREATOR OF MATTER.

A NEW era is dawning upon the world—an era in which religion will become the deepest science, and science in its truest sense religion. The deeps of existence, psychical as well as physical, are being sounded, and the recent conquests in the domain of science unfold prospects of a mastery of nature such as never before occurred to man—to modern man, at least—in his wildest dreams. What is the domination to be? Are we to witness merely a fresh following of the old road, with telescope, spectrum analysis and chemist's balance for the instruments of advance; or is it the power of mind over matter, directly exerted, which is to be the new solvent of nature's problems, the new agency for bending nature to man's will, for remoulding it into harmony with his highest needs and aspirations?

The question summons us at once to a brief consideration of what we mean by matter and by mind. Are they totally different things? The whole trend of modern thought is in the direction, if not of identifying them with one another, at least of bringing them closer and closer together. The most salient feature of modern progress is the steady shifting of the emphasis from the material to the mind values in the broadest sense of the word. We cognize objects only in terms of our conscious states; in the last analysis all material values are found to be mind

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values. The world as we know it presents itself in two aspects—the outside realm of matter, consisting of objects revealed to us through our senses, and the inner realm of feeling and thought which is without anything like location in space.

Take the outer world and see how far we can trace it. I hold an apple in my hand. What do I know of it? I know its color, its form, its hardness, its taste, its odor—in a word, I know what my five senses tell me. Remove eye, hand, tongue, and these qualities will become non-existent, being conditioned by the nature of my organism. Professor James in his transmission theory maintains that our organism, instead of revealing to us the nature of the universe, limits our knowledge of it by our very constitution to what we acquire with our five senses. We cognize only the things for the perception of which we have corresponding organs. To illustrate: a colored pane of glass —say red—transmits only red rays, shutting out many other vari-colored rays, which, although they cannot be transmitted by the red pane, exist nevertheless. "In my Father's house are many mansions."

Matter is not the ultimate. Beneath matter, science tells us, is ether—the medium which pervades all space—the interstellar immensities as well as the infinitesimal interstices between material atoms. Some modern physicists have compared it to a jelly; others describe it as denser than steel; all agree that it is incompressible and is in some way the reservoir of energy for all material phenomena. The existence of ether is not merely speculation, it is a reality; and Sir Oliver Lodge calls it the most important reality with which we are acquainted. The senses tell us nothing of it, but without ether such phenomena as light, electricity, magnetism, radio-activity, would be impossible. It is through this continuous substance that light passes to us from the sun, stars and other luminous objects; with-

out the undulations which it transmits the whole world of objects which we now see in their shapes, colors and distances, would be invisible. Not only in this way is ether the vehicle of energy flowing in to us from without—it is the very source of the things to which we have access through our sense organs. Subject to some sort of stress, it differentiates itself into matter; in all probability the so-called electrons, which unite to form atoms, are knots or rings formed in and of the ether itself.

Such is the outer world. What now of the inner, which we know only as states of consciousness? We know it neither as matter nor as motion, but we find it intimately connected with brain, and as the brain is made up of molecules, these must vibrate during the activities of thought. We here have the link connecting the two worlds which at first sight would seem to be so remote from each other. Matter we know through our senses; matter is evolved from ether; ether we do not know; our thought we know. Our thought is not matter, but it is accompanied by vibrations in the ether. Thought is connected with matter through our bodily frame; it is not less distinctly connected with ether through its *modus operandi.* Meanwhile that which logic asserts is fast becoming the favorite conclusion of science. Not only naturalists like Naegeli and Haeckel maintain that matter is endowed with elementary feeling; the physicists also incline to this view, and Sir Oliver Lodge in his book on *The Ether of Space* writes:

"The universe we are living in is an extraordinary one, and our investigation of it has only just begun. We know that matter has a psychical significance, since it can constitute brain, which links together the physical and the psychical worlds. If any one thinks that ether, with all its massiveness and energy, has probably no psychical significance, I find myself unable to agree with him."

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And Camille Flammarion sums up the argument of his book on *Mysterious Psychic Forces* in the words:

"The phenomena of which we are speaking are manifestations of the universal dynamism with which our five senses put us very imperfectly in relation. We live in the midst of an unexplored world in which the psychical forces play a role still very insufficiently investigated. These forces are of a class superior to the forces usually analyzed in mechanics, in physics, in chemistry. They are of the psychical order, have in them something vital and a kind of mentality. They confirm what we know from other sources, that the purely mechanical explanation of nature is insufficient, and that there is in the universe something other than so-called matter. It is not matter that rules the world; it is a dynamic and psychic element. . . . There is in nature, especially in the domain of life, the manifestation of instinct in vegetables and animals, in the general soul of things, in humanity, in the cosmic universe, a psychical element which appears more and more in modern studies, especially in researches in telepathy, and in the observation of the unexplained phenomena which we have been studying in this book."

Science not only shows us how moving matter causes vibrations in the ether, producing motion in other matter at a distance; it also enables us to realize the possibility of action at a distance by means of thought, and this without the instrumentality of speech, telegraph wires, or other physical agencies. For if thought be accompanied by molecular vibrations in the brain, the ether must be moved by these just as it is moved by the vibrations which produce the phenomena of light and electricity. Said Sir William Crookes, the famous English physicist, in his address as president of the British Association for 1898:

"It would be well to begin with telepathy, with the fundamental idea that thoughts and images may be transferred

from one mind to another without the agency of the recognized organs of sense; that knowledge may enter the human mind without being communicated by any hitherto known or recognized ways.... If telepathy takes place, we have two physical facts—the physical change in the brain of A, the suggestor, and the analogous physical change in the brain of B, the recipient of the suggestion. Between these two physical events there must exist a train of physical causes. Such a sequence can only occur through an intervening medium. All the phenomena in the universe are presumably in some way continuous, and it is unscientific to call in the aid of mysterious agencies when with every fresh advance in knowledge it is shown that ether vibrations have powers and attributes abundantly equal to any demand—even to the transmission of thought.... It is known that the action of thought is accompanied by certain molecular movements in the brain, and here we have physical vibrations capable from their extreme minuteness of acting direct on individual molecules, while their rapidity approaches that of the internal and external movements of the atoms themselves.... It will be found possible to discover a path by which telegraphing without wires and transferring thought from mind to mind can be found to harmonize."

Examples of this possibility of moving the matter of the human brain at a distance by the putting forth of purely mental power have been gathered in thousands by societies for psychical research on both sides of the water. It is only a step further to show that matter outside the human brain—matter which is inorganic—may also be moved and influenced by the action of mind. In 1871, Sir William Crookes published an account of experiments conducted by him, under a system of rigid scientific tests, which established "the existence of a new force in some unknown manner connected with the human organization, which for

convenience may be called the psychic force." In this account Sir William demonstrated that by putting forth of the psychic force it is possible to alter the weight of bodies and play upon musical instruments without direct human intervention.

But there is still a third stage in the power thus exerted by mind upon matter—that of actually creating it. For what does the creation of matter really mean? It does not mean the bringing of matter into existence out of nothing; it simply means the rearrangement of the atoms which already exist. The ultimate parts of all kinds of matter are the same; the different types of matter known to us are due to different combinations and motions of the ultimate units, and these units are simply modifications of the ether itself. Tarde, the French writer, maintains that all spatial likenesses in the universe, and therefore the likenesses of the ultimate parts of matter, are due to likenesses of vibration; and if the mind be capable of giving rise to vibrations in the ether, it should be able to call matter from the ether. It was Sir William Crookes who, alluding to Tyndall's assertion that he saw in matter the promise and potency of all forms of life, said: "I should prefer to reverse the apothegm and say that in life I see the promise and potency of all forms of matter."

Some time ago Professor Ramsey startled the scientific world with the announcement:

"I have found that when electricity is passed through a vacuum tube containing a little hydrogen, two other gases, helium and neon, appear....The chief value of these experiments is that they point the way for a change of one form of matter—an element supposed to be incapable of change—into another, or that it shows that what we have hitherto considered as substance is but a manifestation of forces. In any case a severe blow has been dealt to the present theories concerning the constitution of mat-

ter....It means that we must cease to believe in and to speak of 'elements.' We must adopt new phrases. New theories, founded largely on the old ones but with serious modifications, must be advanced. We must experiment further with electricity and its effects upon matter. I imagine that if any experiments are carried on, we shall discover many startling facts concerning electricity and may even discover a new and enormously large source of electrical power."

Where shall we look for this unknown source of power, and what may be its *modus operandi*? Thus far we have seen that logic and scientific research admit of the possibility of synthesizing matter out of ether. The principle that underlies this creation and predetermines the resultant forms and shapes is the one with which human thought has wrestled from time immemorial, whether calling it the "idea" of Plato, the "*élan vital*" of Bergson, or simply the "first cause." In the universe this principle manifests itself as motion along the path of least resistance, thus fulfilling that law of harmony and unity which like a thread of gold runs through the whole fabric of creation, from the orbits of planets and stars to the circling motions of electrons in atoms, from the formation of a snow crystal and the wing of a butterfly to the Greek Parthenon, a Madonna of Raphael, a symphony of Beethoven or a sonnet of Shakespeare. In other words, the intelligent principle is the mode in which the universe works in what is called evolution, and therefore has its outcome in forms and motions characterized by harmony and unity. Ether, in differentiating itself, first produces electrons, which in their turn give rise to atoms. These, following the path of the least resistance and subject to unlike stress, unite to form different kinds of matter, until finally the creative activity exerted by the universe passes over into the organism in a highly complex form.

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Man as an organism also creates intelligent forms by virtue of his derivation from the universe. At first he creates by moulding objects with his hands, and later by means of machines. But this is only the initial stage of his creative power. Mind comes to have greater and greater meaning in his development and activities. As the individual mind gets more from and cooperates more with the race mind, human advance is accelerated. A further stage of this development will come when, instead of using hands, tools and machines to supply his needs and shape his environment, man will accomplish these ends by means of brain waves generated by his thought. These waves will be creative, just as the ether which produced and moulded matter is creative, since both are ultimately of the same nature. They will result in forms which are intelligent because the production of such is the end toward which all activities ultimately tend. The link between these effects of thought and the effects produced by the universe is the link of a fundamental process which is common to all existence. But in order to be creative these thought waves must be rhythmic, that is to say, they must move in accordance with the laws of harmony and unity—this is the cardinal condition, the *sine qua non* of the mind's mastery over matter, the *raison d'être* of all religions, the logical deduction of all modern science. The power of rhythm in ether may be brought home to us by the force of rhythmic waves in our material world. It is a well-known fact that a body of soldiers must break step when crossing a bridge to prevent its collapse under their rhythmic tread. The fall of Jericho's walls at the trumpet blasts of the Israelites may be cited in illustration of the force exerted by sound-waves. Religion is in complete accord with science when it inculcates goodness, righteousness, moral perfection in man, for in this direction lies man's oneness with his Creator. "Except ye become as little

children ye shall not enter into the kingdom of heaven." By achieving unity and harmony within himself and with his fellow beings man will put himself in tune with the universe, and wield the powers of the cosmos itself—his rhythmic thought-waves acquiring under these conditions the power to liberate what are called the "intra-atomic energies" and shape them at will. This power at present is dormant or dissipated, largely because of the conflicts and cross-purposes which continue to divide mankind.

The newly-discovered phenomena of radio-activity go far toward bridging the gap between matter and mind. They show that matter is continually undergoing disintegration, and that by rearrangements due to this disintegration material substances change one into another—uranium into radium, radium into helium, neon or argon; copper into lithium, thorium into carbon, the series closing, it is believed, with lead. Nature, presenting us these transformations in progress on a large scale, reveals one of the methods by which matter is created, and suggests the possibility of advance, not only to physical means of imitating such processes, but also to the reproducing of them by mental action. Has not such a power of creating matter been already exercised in the past? Does not progress move in cycles, and has not humanity gained again, by infinite struggle that which it lost through some mistake or blunder of its own? This is the view expressed by Professor Soddy, the English physicist, in his *Interpretation of Radium.*

"Some of the beliefs and legends which have come down to us from antiquity are so deep-rooted that we are accustomed to consider them almost as old as the race itself. One is tempted to inquire how far the unsuspected aptness of some of these beliefs and sayings to the point of view so recently disclosed is the result of mere chance or coincidence and how far it may be evidence of a wholly unknown

and unsuspected civilization of which all other relic has disappeared. It is curious to reflect, for example, on the remarkable legend of the philosopher's stone, one of the oldest and most universal beliefs, the origin of which, however far back we penetrate into the records of the past, we do not seem able to trace to its source. Let us give the imagination a moment's further free scope in this direction.... What if this point of view that has now suggested itself is true, and we may trust ourselves to the slender foundation accorded by the traditions and superstitions which have been handed down to us from prehistoric time? Can we not read into them some justification for the belief that some former forgotten race of man attained, not only to the knowledge we have so recently won, but also to the power which is not yet ours? Science has reconstructed the story of the past as one of the continuous ascent of man to the present-day level of his powers. In face of the circumstantial evidence existing of this steady upward progress of the race, the traditional view of the fall of man from the higher, former state has become more and more difficult to understand. From our new standpoint, the two points of view are by no means as irreconcilable as they appear. A race which could transmute matter would have little need to earn its bread by the sweat of its brow. If we can judge by what our engineers accomplish with their comparatively restricted supplies of energy, such a race could transform a desert continent, thaw the frozen poles, and make the whole world one smiling garden of Eden. Possibly they could explore the outer realm of space, migrating to more favorable worlds, as the superfluous to-day migrate to more favorable continents. One can see also that such dominance may well have been short-lived. By a single mistake, the relative positions of nature and man, as servant and master, would, as now, become reversed, but with infinitely more disastrous consequences, so that

even the whole world might be plunged back again under the undisputed sway of nature, to begin once more its upward, toilsome journey through the ages. The legend of the fall of man possibly may indeed be the story of such a past calamity."

Our modern knowledge of psychical phenomena may thus be a merely recovered remnant of knowledge once possessed in vastly greater fulness. There may have been a time when telepathy was as common and as highly developed for the practical purposes of life as telephony and telegraphy are to-day. The occultism of the East and the strange powers of communicating information to a distance possessed by many savage tribes suggest an age in which, by mind action alone, results were achieved that in our time would be called miraculous. And when an exact man of science suggests that our race was once able to disintegrate matter and mould it into new forms at will, it is surely no mere poetic fancy to imagine that this power, existing at all times potentially, may finally be put forth dynamically in acts of mind.

The merely physical aspect of radio-activity is itself a revelation of such startling importance as to be almost incredible.

"Radio-activity," says Professor Soddy, "has raised an issue which it is safe to say will mark an epoch in the progress of thought. With all our mastery over the powers of nature, we have adhered to the view that the struggle for existence was a permanent and necessary condition of life. To-day it appears as though it might well be but a passing phase to be altogether abolished in the future, as it has to some extent been mitigated in the past by the unceasing, and as it now appears, unlimited ascent of man to knowledge, and through knowledge, to physical power and domination over Nature."

The struggle for existence to-day among human beings

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is largely a struggle for energy, and it is because of the insufficient supply of this that competition is so fierce, in many respects even so unmoral, and that money, which is simply so much energy, is so unequally distributed. Science now opens up the prospect of such a mitigation of the struggle as will lay at least a physical foundation for a new order of society. When it becomes possible to liberate and to utilize the "intra-atomic energies," matter will supply us with the powers needed for life and social progress in such unlimited quantity as literally to change the face of the world.

The process of creating matter out of ether is much simplified by the consideration that atoms, being already in existence, the transmutation of one set of them into another, would be all that is necessary to obtain any desired material results. Says Soddy in *Matter and Energy*:

"The discovery of the relation of the atom to energy within the last decade recalls the strange medieval myth that the Philosopher's Stone, which had the power of transmuting metals, when discovered, would prove also to be the elixir of life. Transmutation, the pulling to pieces and putting together of atoms, would render available the primary sources of energy, which maintain the time-defying processes of cosmical evolution."

Such a philosopher's stone man possesses in his brain with its brain waves. It is generally agreed now that all life is inseparably bound up with electricity, and that our own organism is nothing but a storage electric battery, while our brain waves are disturbances in the ether similar to light or electric waves. The extreme minuteness of these brain waves does not militate in the least against their becoming, while acting rhythmically, the greatest source of power ever at the disposal of man, any more than the extremely small attractive power of amber known to the ancient Romans militated against electricity becoming the

mighty agent of power it is at present. Sir Oliver Lodge says:

"If the ether can be set spinning, we may have some hope of making it imitate the properties of matter, or even of constructing matter by its aid. But how are we to spin the ether? Matter alone seems to have no grip of it.... We cannot spin ether mechanically. But we can vibrate it electrically; and every source of radiation does that. An electric charge, in sufficiently rapid vibration, is the only source of ether waves that we know; and if an electrical charge is suddenly stopped, it generates the pulses known as X-rays, as the result of the collision. Not speed, but sudden change of speed, is the necessary condition of generating waves in the ether by electricity. We can also infer some kind of rotary motion in the ether; though we have no such obvious means of detecting the spin as is furnished by vision for detecting some kinds of vibration. Rotation is supposed to exist whenever we put a charge into the neighborhood of a magnetic pole. Round the line joining the two the ether is spinning like a top. I do not say it is spinning fast; that is a question of its density; it is, in fact, spinning with excessive slowness, but it is spinning with a definite moment of momentum.... The fact of such definite rotation was discovered by Faraday.... In whatever way it is regarded, it is an example of the three rectangular vectors. The three vectors at right angles to each other, which may be labelled Current, Magnetism and Motion, respectively, represent the quite fundamental relation between ether and matter, and constitute the link between electricity, magnetism and mechanics. Where any two of them are present, the third is a necessary consequence. This principle is the basis of all dynamos, of electric motors, of light, of telegraphy, and of most other things. Indeed, it is a question whether it does not underlie all that we know in the whole of the physical sciences;

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and whether it is not the basis of our conception of the three dimensions of space."

Since mathematics offers us a glimpse into a fourth dimension of space as yet transcending our actual experience, why could we not put the brain waves, of whose force we have already a glimmering, however faint, in the same group with current, magnetism and motion—all being fundamentally but modes and manifestations of one common energy, the ether?

The fact that it is associated with man's organism, and is an emanation of both his physical and spiritual nature, invests with a special significance this hitherto almost wholly unexplored force. Nor were the scientists slow to recognize the portentous value of brain waves and try to reduce their manifestations to strictly scientific data.

A discovery of this kind was a few years ago announced to the French Academy of Sciences in the form of observations showing the existence of a vital emanation from the human body, "analogous in its behavior to that of radium, Crookes' bulbs, X-rays, radio-activity" and like them capable of producing images on the photographic plate. The evidence for these experiments cannot yet be considered conclusive, but it is a fact of enormous significance that such experiments are being made. Science first heard of them thirty years ago; they have been frequently repeated since then; and the French savant's belief that there is some new knowledge to be won in this direction may very well indicate the path along which humanity is yet to travel. If a tiny bit of inorganic matter like radium, extracted with infinite toil and patience from a mass of pitchblende, can display powers which astonish the scientific world and revolutionize scientific conceptions, what might not be expected from "vital rays," and still more from the subtle activities of the human brain?

It is interesting to note that in the past human reverence

has persistently surrounded the heads of saints and divine personages with halos. May these halos not only represent power outflowing from the human brain, but also stand for harmony between spirit and matter—a harmony such as was meant by Kant when he spoke of "good-will," such as found complete manifestation in the divine personality of Christ at whose word spirit (or ether, or whatever it may be called) was translated into matter? Are we not justified in assuming that the mistake, the blunder to which Professor Soddy refers—the serpent that crept into the garden of Eden and caused the fall of man—may well have been the evil which, entering the human soul, disrupted the harmony between matter and spirit and plunged the race into the lower state of toil and pain?

Staggering and stupendous as is the contention that rythmic thought waves are capable of synthesizing matter from ether, it is by no means far fetched, but fully borne out by the past achievements in the domain of science. Electricity, as a force, has always existed; as a factor in human progress, it is a mere infant born of yesterday. Could you have told an ancient Roman, as he amused himself by rubbing a piece of amber and watching it attract light bodies, that this selfsame power would one day propel over the seas ships a thousand times heavier than the largest Roman galley, that it would carry the human voice over distances farther than the farthest reach of the Roman aqueducts, and even signal human thought far beyond the pillars of Hercules, the ancient Roman would surely have viewed such a prophecy as arrant nonsense if not downright madness.

Thus far we have dealt with the scientific aspect of the problem. Let us now see how far we can rely upon metaphysics in support of this view. From what we know of the universe, both through personal experience, and by way of pure reasoning and deduction, it is clear that the creative

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process in nature must have mind behind it. That is, the contrivances we see in nature cannot arise (1) either by chance, through purely mechanical causation, or (2) by voluntary action and manipulation in the manner in which we human beings produce results and carry out our plans. The mechanical process in nature, that is, causation, must therefore be guided to ends, to the realisation of the results which we call teleological, that is, planned with view to ends. If mind is operative in nature it cannot be merely an abstract principle, but must be an impelling force. It must so permeate and influence cause as to give it the character of a working through means to ends. The mind engaged must be omniscient, aware of all forces and of all possible results which may come from the direction and guidance of them in any particular case. Such a mind must act directly as mind, without needing to be embodied in organic form or to work upon its material by way of the voluntary action through which we accomplish our results as human beings. We must assume therefore that creative power is put forth as a direct influence exerted, first upon ether to differentiate it into matter, and then upon matter to bring into existence the various organic and inorganic forms which make up what we know as the world. Up to the present man's powers of contrivance—of reaching ends by way of means—have been restricted to the physical manipulation of matter by means of his organs, tools and machines, with mind coming in only as a guide to these. In the ultimate stage of our evolutionary progress man's mind must become a direct, and not merely a secondary factor, in his creative activity.

How do the teachings of the foremost metaphysicians of modern times bear out this view? Paul Janet says in *Les causes finales*:

"If each one of the things in the universe taken separately has been produced by another — why, for what

end, all taken together, have they been made? Unity of cause presupposes unity of end. If a single cause has done it all, it must have done it for one end, and as the cause is absolute, the end also must be absolute. But as there are no two absolutes, the cause and the end must be identical; and consequently, God must have made this world for Himself. If God, as absolute perfection, could not have created the world for an egotistic end (for then it would have been simpler not to create it at all), if on the other hand we cannot suppose that He created it only by accident or as a plaything, it therefore follows that He created the world only in the interest of the created beings—that is to say, out of goodness. Such is at least the only way in which the human mind can conceive the reason of creation; such is, translated into human language, the only hypothesis which permits us to conceive of the relation between the infinite and the finite, between the imperfect and the perfect, between the Creator and the creature."

According to Paul Janet, therefore: if the first absolute cause is goodness, the absolute end must also be goodness. God, the absolute cause, by creating the world, had goodness in view as His end. Inasmuch as man is derived from God, man's end must be identical with God's, goodness. By achieving this end, since there are no two absolutes, man *ipso facto* becomes an absolute cause, and therefore at one with God, sharing His power, partaking of His wisdom, and striving for that "divine event toward which the whole creation moves"—that is, the setting up of the kingdom of God on this earth.

Not wanting in analogy to this view is the reasoning by which Henri Bergson seeks to guide us, though along a slightly devious path. His primal cause is the vital urge, the *élan vital,* and he regards it as a sort of divine message which is given out to and expressed in all created things. But it gets garbled in transmission. It is only dimly pre-

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sented in the unconscious world of inorganic matter; it comes out more clearly in the realm of plants and animals; its highest expression is in man. Suppose we accept this vital thrust, this *élan vital,* as a symbol of creative power, through which God acts in and upon all things. It is evident that when transferred, its efficiency must depend on the nature of the instrument through which it is transmitted, and must flow out in all the greater potency according to the degree in which that instrument approaches perfection. Man as he is now is handicapped by the imperfections of his organism, yet even in his present state the divine message is able to manifest itself through him in flashes of intuition. That is why Bergson lays such stress on intuition and extols it above all knowledge acquired under the merely material limitations of man's intellect. It follows from this that the more perfect and good man becomes, the more harmony he brings into his life and thought, the more completely will he be capable of receiving the full efflatus of the vital urge, the *élan vital,* and of applying its creative power to the human environment and to human conditions. Bergson's intuition, separated from knowledge in his system, will then become one with knowledge. In man will be combined the creature and the Creator, the doer and the deed; through him the divine message will pass out to matter as well as to life, and in creative activities will refashion as well as illuminate the world.

The analogy between creative activity in the universe and the creative activity of man finds its full exemplification in the domain of art. Says Janet:

"Nature is no more artist by chance than she is geometer by chance; her esthetics are no more fortuitous than her industry. It is because there is an industry of nature, a geometry and esthetics of nature, that man is capable of industry, of geometry, of esthetics. Nature is all that we are and all that we are is derived from nature. The crea-

tive genius the artist feels in himself is the revelation and the symbol of the creative genius of nature."

And Janet further writes:

"What we call in God the ideal creation (the difference of infinite from finite being understood) is an act analogous to that which we call the creative act of human genius."

According to Goethe's conception, life reaches its highest form in artistic creation because in art nature comes to self-consciousness and shows its inmost essence in visible shape. Schiller assigns to art the same place. His reason is that man, who in the rest of life is divided and shattered, wins his unity through art, so that he may act as one power.

Partaking of the divine creative power, all art is religion. Schopenhauer saw in art the embodiment of the universal will manifested in types that are eternal, time-transcending, immortal. Schopenhauer's theory of art has thus been summarized:

"The idea obtains a relatively complete realization in art (and philosophy) in the creations of genius. While ordinary cognition is merely subservient to the ends of mere living, or is purely relative, esthetic and philosophic cognition are ends in themselves, and reveal the pure idea, since they show the immediate essence or nature,— the "what,"—and not merely the mediate nature,—the "why," or relative causes of things.... In the series of arts constituting a series of objectifications of the idea, architecture contains the idea of mere blind force; sculpture and painting, respectively, of organic (human) form and action; poetry, of historical development; music,—the highest of the arts,—of the inner essence of things."

The secret of the powerful sway of music over the human soul lies in the fact that by its very nature of harmony and rhythm, it is the most immediate in its effects, attuning man to the universal soul. For this reason it has from time immemorial accompanied divine worship, to which all

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the other arts—architecture, sculpture, painting, the inspired word of man—are ancillary.

Finally: how far are the ideas here expressed capable of practical application to every-day life? Will they stand the test of pragmatism? Will they work? Thus far in human history the incentive to moral perfection in man has been a system of rewards and punishments in the hereafter. Be good, says religion, in order that you may enter the kingdom of heaven after death. This system on the whole worked, and the proof is that the world goes on. But it does so laboriously, painfully, haltingly; social readjustments are slow because of imperfect social unification, because of the fact that humanity fails to grasp the fundamental principle, underlying all creation, that goodness is power, that each individual is simply a unit, that his strength comes from the unity and harmony of all. In a word, the system of rewards and punishments as practised to-day, is too remote, too detached from man's life and experience, and for that reason is inefficient and wasteful; it follows, so to speak, a circuitous route, meeting science half way and winking at it from behind hedges. It is out of date, because while in education and even in the treatment of criminals we are gradually seeing light and abolishing the rod, we still lay emphasis on hell in our religion. This antiquated system is bound to be superseded in the course of time by a system of rewards in this present world as offering the highest possible incentive to moral perfection and goodness, with religion and science as a single cult leading humanity harmoniously along a straight path toward the common goal. A constructive view of this sort would naturally leave punishments out of account, except merely as dissuasives.

It may be pertinent here to remark that the great American pragmatist philosopher, Prof. William James, already referred to in this article, saw the need, toward the end

of his life, of a new constructive metaphysics which, by fusing science and religion into one cult, would work for the greatest good of mankind.

To set aright a world manifestly out of joint, we must start at the beginning, with the bringing up of the new generation. What makes a man a Mohammedan, a Buddhist, a Hebrew, a Christian? Clearly, it is the way in which he has been brought up from childhood. It is perfectly practicable to educate children in the idea of attaining goodness in their lives and souls as a means of attaining to God and to all power. The possession of the earth and the fulness thereof is a powerful incentive, and there can be no greater than the cry of the Scriptures, "Oh grave, where is thy victory? Oh death, where is thy sting?"

Far more potent than the lure of immortality beyond the grave is the incentive of immortality in man's actual life, for it is easier for the mind to grasp the idea of uninterrupted bodily existence with all it implies than that of one resumed after the dissolution of the material body with only belief to substantiate the beyond. If, as the scientific argument demonstrates, it is possible to synthesize matter from ether, then it is also possible to achieve immortality. The potentialities of ether being infinite, immortality for human beings may thus mean aspects and modes of existence of which in our present state of knowledge we can form no adequate conception. Nor is the practicability of the incentive invalidated by the consideration that life is too short for any one individual to realize perfection and to achieve divinity in his personal existence. For man does not live for himself alone—more fully and more intensely he lives for his children and for generations yet unborn. But the greatest assurance that this system would work lies in the fact that it would be able to perpetuate itself by the very good it would achieve in uniting mankind as one power.

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There is still one more aspect to be considered: that of the methods by which man may be able to create matter and refashion not merely social conditions, but the very physical environment itself, in the midst of which his lot is cast. How, then, shall he, ceasing to adapt himself to his inanimate surroundings as something which he cannot change, but must take for granted, begin to adapt them to his needs and plans? This can be accomplished only by intense concentration, involving not merely individual, but also social unification. We get the model and forecast of these in the organism itself, where concentration is essential to all activities and to every putting forth of will. The human individual is able not only to work out plans, but to hold his mind definitely on particular ends which he wishes to see realized. How, then, are the numerous individuals who make up society, with different interests and ideals and with conflicting aims, to unite their multifarious will powers with a view to a common result? It must be noted in the first place that a social community is not a mere multiplicity of individual units, but has its members linked together in a thousand ways. To a large extent, and for things common to it, the community thinks in common. It is now recognized that there is a social as well as an individual consciousness, a social will as well as an individual will, and that these collective powers of society are coming to be exerted in a more intense way and over a much wider field than was formerly the case. Communities are more unified than before; they think more and will more in common than at any previous period of social history. If individual telepathy is possible, due to individual consciousness and will, what is to exclude the possibility of a telepathy, of a thought transference which is social in character, which proceeds from the community thinking and willing as a whole?

If, however, the prospect of concentration on so vast

a scale may seem far too remote from the present, history on the other hand furnishes us with ample illustrations of intense individual concentration associated with transcendental powers. Such, for instance, were the mystics of old who, by abstracting themselves from the interests and impressions that constantly bombard our conscious existence, were enabled to unite with the soul of the universe, with God, and thus gain wondrous wisdom and power. The adepts of Yogi in India, the followers of Zen in Japan, all belong in the same class. But perhaps the most shining individual example we see in Buddha who, forsaking the life of pomp and pleasure, retired into himself and meditated upon the miseries of humankind until he became aware of the essence of things and of his own mission. Even so the Son of Man went into the desert and fasted, and prayed, and wrestled with his soul ere he gave himself to the salvation of the world.

Over the bridge that the Past ever throws to the Future we may tentatively trace the route which humanity in ages to come is to travel. With moral perfection as the cornerstone of all individual and universal existence, life must needs become one common prayer, in which human souls, following the path of unity and harmony, as with one accord will become one force, one power. Acting as an impetus in the world of ether, this force will be potent to transform by means of brain waves the pure idea into creative idea, thus completing the cycle as it is now exemplified in the order of creation. Says Janet:

"The principle of good which is in the universe, must be not only conservator, but organizer, creator, promoter."

But after all, the methods and ways and means of concentration are only a matter of detail which we may safely intrust to the future, once the fundamental truth is grasped that by achieving moral perfection man will achieve his unity with God and partake of the divine power of creation.

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By inference this power is at present denied to man because of his imperfect morality, his self-seeking, his lack of harmony and unity within himself and with the rest of mankind. Nor can there be human freedom—all the legislation in the world notwithstanding—until humanity grasps the inner meaning of the fundamental laws of man's spiritual development.

To sum up. The pre-condition of the mastery of mind over matter is harmony and unity in the thoughts of men, and by implication in their lives and actions. Thus harmonized and unified, mind action, giving rise to rhythmic ether waves, would liberate and direct the intra-atomic energies, and open up to humanity the new unknown source of power to which Professor Ramsey alludes. The closing words of Bergson's address before the English Society for Psychic Research seem to point in the same direction, for he predicts that "the science of mind will attain results surpassing all our hopes." The new source of power will enable man to reshape or even create his environment at will. As soon as this truth is realized a new era will dawn upon the world. Blending science and religion into one cult, mankind will devote itself to the task of harmonizing and unifying human thought. The history of civilization is the history of great religious movements. Christianity, Buddhism, Mohammedanism, shaped the destiny of the world by inspiring its people with great ethical principles. The goal of man is to become divine, and the way to attain it is the way indicated by every religion—the *via beatifica.* When every one awakens to the idea that he can help or hinder the bringing of heaven on earth, there will be no need of jails or standing armies. Humanity will then have set out on its quest of the Holy Grail. Thus the greatest power in the world is the power of thought, since behind it is that something—the "substance" of Spinoza, the ether of modern science—in a word, the spirit out of which all

things arise. Ultimately, the forces at work in the world will not be measured in terms of horse-power, of foot-pounds, of calories, but in terms of mind—unified, harmonious, creative. There is awe-inspiring grandeur in the conception of the potential worlds embodied in ether which, at the call of man, the creator, may arise and be.

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BODY AND MIND.

ALL unsophisticated people believe that their minds act on their bodies and their bodies on their minds. If some one sticks a pin into me and I feel a painful sensation, it seems obvious that the entry of the pin into my body is the cause of the sensation in my mind. Similarly if I will to move my arm it seems obvious that the volition in my mind causes the movement of my body. The view that mind acts on body and body on mind may be called "two-sided interactionism."

In spite of the fact that interactionism seems at first sight to be certainly true, we have to notice that it is at the present time rejected by what is probably a majority of scientists and a majority of philosophers. Most people who have studied the subject from the side either of philosophy, or of physics, or of physiology have come to the conclusion that the mind does not act on the body and that the body does not act on the mind. Such a strange conclusion and one so contrary to the belief with which we all start must need powerful arguments to support it; and what I propose to do in this paper is to state and criticize the most important of these as carefully as I can.

Before entering into these arguments in detail, I would like to point out that this is essentially a question which cannot profitably be discussed by mere philosophers or by mere scientists, but only by persons with a competent knowledge both of philosophy and of natural science. The

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question is: are events of a certain kind causally connected with events of a certain other kind, or are they not? To answer such a question one must have a competent knowledge of the two kinds of events and their laws, and one must understand exactly what is meant by causation. Now mental events and their laws are treated by psychology, and bodily events and their laws are treated by mechanics, physics, chemistry, and physiology. Hence some knowledge of all these sciences is necessary before one can discuss this question. But, though it is necessary, it is not sufficient. All natural sciences make constant use of the notion of causation, but the notion of causation does not form part of the subject matter of any natural science. Causation, its precise limitations, are part of the subject matter of philosophy. Similarly arithmetic makes continual use of reasoning but it is not about the process of reasoning, for this is dealt with by logic.

With these preliminary remarks we may turn to the special arguments which have been used against interactionism. I will begin with two purely philosophical arguments. They seem to me quite worthless and we may as well clear them out of the way at once.

I. One argument is that body and mind are so entirely unlike each other that it is inconceivable that events in one should cause events in the other. How could two events so different as eating a beefsteak and thinking of a poem, or having a volition and making a bodily movement be causally connected? This argument assumes that events can only cause each other if they be sufficiently similar, that if they be sufficiently similar their causal connection is intelligible, but if they be very different it is inconceivable. The answer is (*a*) that however similar two events may be the fact that one causes the other is never self-evident but has to be learnt by experience. It is not *a priori* self-evident that one billiard ball moving straight on to

another will make the second move in the same straight line; we have simply learnt that this is what actually happens. We have exactly the same kind of evidence for the view that sticking a pin into a man's body causes a painful sensation in his mind. In neither case is the connection intelligible, if by intelligible you mean logically deducible from what is otherwise known of the nature of billiard balls or of pins respectively. In both cases it is intelligible, if by this you mean that it is a fact which involves no contradiction and is actually found to be true. (*b*) We are not told in this argument how dissimilar events must be before it becomes unintelligible that one should cause the other. A draught is not particularly like a cold in the head, but no one who habitually changes trains at Clapham Junction will deny that the former may cause the latter. And if the dissimilarity between a draught and a cold in the head does not render their causal connection impossible, I fail to see why the difference between a pinprick and a painful sensation should make *their* connection unintelligible.

II. A more refined form of philosophical argument is the following. It is said that wherever we have a genuine instance of causation the events are connected by a great many other relations as well as the causal one. The two billiard balls have definite spatial relations to each other, and so on. It is argued that there are no such relations between a pinprick and a painful sensation or a volition and a bodily movement. The mental states are not in space and the bodily events are, hence there can be no spatial relations between them. Hence it is argued that mental and bodily events cannot be causally connected. Although this argument has the support of so eminent a philosopher as Professor Stout, I must confess that I can see very little in it. I have four objections to it. (*a*) How do we know that the causal relation can only subsist between two events

when other relations subsist between them too? It does not seem self-evident and I know of no attempt to prove it. (*b*) How do we know that there are not other relations between mental and bodily events? It is perfectly conceivable and even probable that bodies have many qualities which we cannot perceive owing to the very limited range of our senses. It is still more likely that states of mind have many properties which we cannot detect by introspection. I see no difficulty whatever in supposing that there may be plenty of relations between states of mind and states of body of which we are unable to become aware. Now, if this possibility be granted, it seems much more reasonable, in view of the strong appearances in favor of interactions and the difficulties which we shall find in all alternative views, to suppose that there really is interaction and that we are unable to become aware of the other relations than that no other relations exist and consequently there is no interaction. (*c*) But, further, in certain cases we can actually see that there are other relations between mental and bodily events. When I will to move my arm I have to think of my arm and of its present and its future positions. Here we have at once a definite relation between volition and bodily movement, viz., the fact that the part of the body to be moved and its movement must be objects of thought to the mind. This is just as good a relation as the spatial relations of the billiard balls. Since mind and body are very different we need not be surprised to find that the relations between mental and bodily events when they interact are considerably different from those between two bodily events when they interact. (*d*) Finally, a man who believes that mind and body interact is not obliged to suppose that a bodily event is ever the total cause of a mental one or conversely. It is quite open to him to think that a painful sensation has a complex cause one part of which is a pinprick and the other some state

of his mind. There is much in our experience to favor such a view and nothing against it. E. g., a person who is kicked with the same hardness, once when he is sitting quietly and at another time when he is playing in a football match, will have considerably different sensations in the two cases. This suggests that the sensation felt is a joint product of his body and his mind. If his body had not been kicked he would not have had the painful sensation, if his mind had not been attending intently to the game the sensation would have been much more painful. But, if states of mind are often the joint products of states of body and of other states of mind, and conversely, the objection that there is no other relation between the alleged cause and the alleged effect obviously breaks down; for there will be an intimate relation between the mental factor in the total effect.

For these reasons I think that the purely philosophical arguments against interaction have no tendency to refute the view of common sense, and therefore we may turn to arguments based on the accurate observations and the accepted laws of natural science.

The most important argument of this kind is based on observations on the energy-changes in the human body and on the physical principle of the conservation of energy. But closely connected with and supporting this argument is one based on the fact that all nervous process is physiologically of the reflex type. I will deal with these two arguments in turn. The one about the conservation of energy will occupy us for some time, for we shall have to make clear (*a*) what are the observed facts, (*b*) what is really meant by the conservation of energy and in what sense it is probably true, and (*c*) what bearing the observed facts and the principle really have on the question of interaction.

a. The following are the observed facts. Very careful experiments have been performed on human beings with a

view to testing whether any changes of energy occur in human bodies which cannot be accounted for by the chemical energy produced by the oxidation and other changes in the chemical energy of the food which a man eats. When a man moves his arm there is an increase of kinetic energy. But it is found that, within the limits of experimental error, this increase is compensated for by a decrease in the chemical energy of some part of his body. The upshot of the matter is that competent observers after careful experiments seem to be convinced that the system composed of a human body, the air that it breathes, the food that it eats, and the heat that it evolves is energetically a closed system. That is, it is a system whose total energy remains unchanged, an increase in one factor being compensated by a decrease in some other factor. I do not intend to criticize these observations, which seem to have satisfied competent observers, except on one point. It seems to me that such experiments can only tell us what is true on an average over a long space of time. To make them perfectly satisfactory one would need to know the total chemical energy in the man's body at each moment of the experiments. This we naturally cannot do since it would involve killing the man and analyzing his body at each moment; a process which would be both illegal and physically impossible, since it would involve killing him to get one's observation and bringing him to life again to continue the experiments. Remembering these limitations we can say that the net result is that over the period of the experiment the total amount of energy given out by the body in heat and movement balances that lost by the food eaten and the air breathed. This leaves it perfectly open to us to hold that the balance is not maintained at every moment, that sometimes there is more and sometimes less total energy present in the system, but that these differences average out over a long period and are never very great.

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It is doubtless true that we should always find that when less energy was being given out in heat and movement than was being taken in in food and air the weight of the man's body increased. We could thus conclude that chemical products were being stored up in the man's body and might suspect that their chemical energy would make the balance right. But we cannot be sure of this because we cannot kill the man and discover just what these storage products are and hence what their chemical energy is. We cannot therefore be perfectly sure that the total energy of the system never decreases, though we may very strongly suspect this. We are on safer ground in concluding that the total energy of the system never increases. When more energy is given out in heat, movement, and waste products than is being taken in in food we shall find a decrease in weight in the man's body. This will lead us to ascribe the balance to the oxidation of stored products. An analysis of the waste products may then tell us what these stored materials must have been and from this knowledge we can deduce the chemical energy which will be liberated by their oxidation.

The upshot of the matter seems to be that (1) we can be pretty certain that in the long run and on the average the energy given out by the body balances that taken in. (2) That we can be pretty sure that at no moment does the total energy of the system increase. (3) That we may strongly suspect, but can never be quite so certain, that at no moment does the total energy of the system decrease.

b. We have so far spoken of energy as if every one knew what it was, and of the conservation of energy as if this were an unambiguous principle which was certainly true. We must now try to become clear on these two points. The only perfectly clear meaning of energy and its conservation is found in kinetic energy in mechanics and in the collision of perfectly elastic bodies. All other forms of

energy and all statements about their conservation are not matters of pure observation but are a mixture of observation and convention. This I will now try to show.

The kinetic energy of a body of mass m moving with a velocity v is defined as the product $\frac{1}{2}mv^2$. Since mass and velocity can be measured kinetic energy can also be measured. If two perfectly elastic bodies (*e. g.*, two billiard balls) collide it is found that the sum of their kinetic energies before and after impact is practically the same, though the distribution of it between the two may be greatly changed by the collision. Here everything is measurable, the meaning of the law is perfectly clear and there is no element of convention in it. The next stage is the introduction of the notion of potential energy in mechanics. Suppose that a body with kinetic energy $\frac{1}{2}mv^2$ moves up against a perfectly elastic spring and presses it inward. The velocity of the body and hence its kinetic energy will gradually be reduced to nothing. But subsequently the spring will expand again and impart velocity to the body in the opposite direction. And it is found that when the body once more leaves the spring its kinetic energy will again be approximately $\frac{1}{2}mv^2$. These are the actually observable facts. It is clear that, if we confine ourselves to kinetic energy, this has not been conserved. It has in fact passed through all the values between 0 and $\frac{1}{2}mv^2$, and so at all intermediate stages of the transaction the kinetic energy has been less than at the beginning and end. Now the conservation of energy is only maintained by postulating a new kind of energy *ad hoc* and giving such a measure to it as will preserve the principle intact. It is said that as the body loses kinetic energy the spring gains potential energy and conversely. Now potential energy, unlike kinetic energy, cannot be directly measured; we merely ascribe to it such values at any moment as shall keep the principle true. There is therefore an element of "cooking"

or convention in the principle even as applied to such abstract cases as purely mechanical transactions between perfectly elastic bodies. All that we can say is that the assumption of potential energy and the ascription of this value to it are compatible with the observable facts, not that they are necessitated by them.

If now we leave purely mechanical events and purely elastic bodies a further dose of convention is needed to preserve the principle, though there are also further observed facts to take into account. If we used billiard balls of lead or putty we should find that the kinetic energy was nothing like the same after a collision as before. Nor could we put this right by assuming potential energy and giving an appropriate measure to it, for we should find that the bodies, unlike the spring in the last example, had been permanently deformed. And, so long as we keep to mechanics, we must simply say that the principle has broken down beyond hope of further "cooking." But, by extending our observations beyond mechanics, we can discern a further important law of motion; and, by a liberal dose of convention, we can state this law in such a way that the conservation of energy can be retained. We shall find that when bodies are permanently deformed other physical phenomena occur. Their temperature rises, they may give out sound waves, or they may produce electrical phenomena. We can directly measure quantity of heat in its own units. And it has been abundantly proved that when a certain amount of kinetic energy disappears from a system and no other change takes place except a rise in temperature the amount of kinetic energy lost measured in mechanical units and the amount of heat gained measured in thermal units bear a constant relation. The same is true when heat disappears and kinetic energy is the only result. Note that, strictly speaking, there can be no question of equality. Kinetic energy is one thing, heat is another; a unit of

kinetic energy is different from a unit of heat, and it is really meaningless to talk about equality between the two. All the observed facts tell us is that the number which measures one in its units bears a constant relation to the number that measures the other in *its* units. The same is found to hold for other physical phenomena like light, sound, and electricity. Now these observed facts can be stated in the form that quantity of heat, electric potential, etc., are forms of energy and that when ever one disappears from a system an equal quantity of the other takes its place. Quite strictly speaking this is nonsense, because you can no more talk of a quantity of heat being equal or unequal to a quantity of electric potential than of an archdeacon being equal or unequal to a quadratic equation. Equality and inequality, in the strict sense, can only hold between two quantities of the same kind; and a quantity of heat is not of the same kind as a quantity of electric potential. But this way of talking is convenient in practice, and, by adopting it, the form of the conservation of energy can be preserved when it would otherwise break down. We may sum up then as follows: Strictly taken the conservation of energy is a meaningless and nonsensical proposition. But, interpreted liberally, it is a statement of the observed fact that in mechanical, physical, and chemical phenomena, when n units of any one kind disappear from a system there will be an increase in the number of units of some of the other kinds in the system, and the numerical values of these increases will bear a constant ratio to n. It must be added that this will only be true if the system is isolated; otherwise, as when heat leaves a system by radiation, the compensating change may happen in some other system. The law will then hold of the two systems taken together, but not of either taken separately.

c. Now this principle, together with the experimental facts about the energy-changes in the human body de-

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scribed above, is taken to prove that the mind does not act on the body and that the body does not act on the mind. The question for us is: Does it prove anything of the sort? I take the argument to be this. Experiment proves that the body, its food, air, etc., form an isolated energetic system. Any change in the energy of the body is completely balanced, in the sense given above, by other changes in the energy of this system. If the mind acted on the body this system could not be isolated, energy would appear in it when we made a voluntary movement, and this energy would not be balanced by the disappearance of energy from any other part of the system. Similarly if the body acted on the mind energy would disappear from the body when the mind had a new sensation, and this energy would not be balanced by an increase somewhere also in the system. As this balance actually does take place mind cannot act on body and body cannot act on mind.

This argument, which has convinced a great many eminent persons of the impossibility of interaction, seems to me to have no weight at all against the evidence from constant experience in favor of interaction. I will now state why it appears to me to be worthless. It assumes that if body and mind interacted with each other we should have to assume a new kind of energy—mental energy—in order to preserve the conservation of energy. We should find energy unaccountably appearing in the body when we made a volition to move and unaccountably disappearing from it when a pin entering our bodies was followed by a sensation in our minds. Since we do not need to assume mental energy it is concluded that there can be no interaction. But this would only follow if it were certain that two things cannot interact without changes of energy in each. Now this is not asserted by the conservation of energy at all. What is asserted is that *if* things interact and *if* their interaction be accompanied by change of energy, then these

changes will obey the conservation of energy. The conservation of energy then by itself has no bearing on the question of interaction. It is true however that when physical systems interact with each other there are changes of energy in both; though this could not have been foretold from the conservation of energy. But this does not in the least prove that *all* interaction must be accompanied by changes of energy; in particular it leaves it a perfectly open question whether, when a mind interacts with a body, such changes take place. The experimental facts strongly suggest, though they do not prove, that the interaction of mind and body is not accompanied by changes of energy; they have not the faintest tendency to show that no interaction takes place. And the conservation of energy, which is apparently supposed to be the bulwark of this argument, turns out to have as little to do with the case as "the flowers that bloom in the spring."

On the same experiments and the same physical principle another argument is often based. It is said that the experiments prove that the body and its surroundings obey the conservation of energy and that it follows from this fact that everything would proceed in exactly the same way in the body if it had no mind and in the mind if it were not connected with a body. The results of this suggestion are so startling that it may be worth while to consider them for a moment before dealing with the validity of the argument. The L. N. W. Railway was ultimately built entirely by the bodily movements of human beings, and the trains run at stated times from the same causes. If these bodily movements were to take place just the same apart from minds we should have to believe that, although there had never been the faintest glimmer of intelligence on the earth, the L. N. W. Railway would still have been built and that trains would still run into and out of Euston driven by mindless engine drivers and containing mindless passen-

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gers reading newspapers printed by mindless printers. Now it really seems incredible that all these things should go on as before if there had been no minds; we should surely expect to find an immense and noticeable difference in everything (except possibly the newspapers). Similarly if the body never acts on the mind we must believe that all our mental states are caused by other mental states. There could be no question of getting a new idea from reading a book or a new sensation from sitting on a tintack, for books and tintacks are alike physical objects. And if we resolutely reject the obvious physical causes of such new sensations and ideas we can find no trace of any mental cause in our past history for them. Any argument which leads to such extraordinary conclusions as this will need to be very strong indeed before it can be reasonable to accept it. In actual fact the argument is extremely weak. Since *every* physical system obeys the conservation of energy the mere knowledge that some particular system such as the human body obeys it will not tell us what that system in particular will do. The system composed of a gun, a bullet, and an explosive obeys the conservation of energy; when it is not discharged the bullet and gun have no kinetic energy and the explosive has great chemical energy, when it is discharged the kinetic energy gained by the bullet and gun is balanced by the chemical energy lost by the explosive. But this knowledge does not suffice to tell us either that the gun will be discharged, or, if so, when it will be discharged. It does not even tell us in what proportion the kinetic energy will be divided between the gun, the bullet, and the gases evolved when the gun is discharged. Similarly the mere knowledge that the human body obeys the conservation of energy does not tell us that it will do anything at all, nor does it tell us what it will do and when it will do it if it does anything. Once again then an argument against interaction which professes to be based on

the conservation of energy and on the experiments that have been made on the energy-changes in human bodies is found to rest on neither. What does this argument really involve then? We find in all purely physical and chemical systems, i. e., non-living material systems, that, although the conservation of energy does not determine whether or when one kind of energy will disappear and another kind appear, yet these transformations do obey definite laws. Thus the gun goes off when the temperature is sufficiently and suddenly raised or when a shock is administered to the explosive. We may then define a purely physico-chemical system as one which obeys the conservation of energy, and in which, further, the transformations of energy which take place and the times when they take place are determined by purely material causes according to the special laws of physics and chemistry. Now if the human body were such a material system as this it would follow that the mind could not act on the body, though it would not follow that the body could not act on the mind. A purely physico-chemical system is defined as one where the only causes of change are material ones acting in accordance with physico-chemical laws. If the only causes be material it is clear that none of them could be mental, and that the mind could not act on the body. On the other hand, even if all the transformations of energy in the human body were determined physically or chemically it would not follow that they might not also cause changes in the mind. It is true that physical and chemical changes do not cause sensations when they occur in non-living bodies, but that may perfectly well be because such bodies do not have any minds attached to them in which sensations could be caused. It may quite well be a law of nature as invariable as any of the laws of physics and chemistry that all material systems of the form and complexity of living bodies are accompanied by minds; and that, although the changes in

these systems take place entirely in accordance with the laws of physics and chemistry, yet certain of them also cause changes in the minds which, by an invariable law of nature, are attached to such material systems. Nothing that we know about the experimental facts or the laws of physics and chemistry precludes this possibility, and our knowledge that certain bodily changes are always followed by certain sensations and that no other cause for these sensations can be plausibly suggested makes the possibility highly likely. We may call the view that body acts on mind but mind does not act on body "one-sided interactionism." We see then that if it can be proved that all bodily changes take place entirely through chemical and physical causes the most reasonable view to take of the relation between mind and body will be that of one-sided interactionism.

For some reason one-sided interactionism is always stated in a peculiarly absurd form by philosophers and scientists, and is then easily refuted. It is nearly always identified with what is called "epiphenomenalism." This is the doctrine that mental states have no effect either on the body or on each other, that each is produced separately by some bodily change and makes no further difference to anything either mental or bodily. Now if this were the only form that one-sided interaction could take it might fairly be regarded as a preposterous theory. But there is not the least reason either in logic or in any known facts why one-sided interactionism should take the form of epiphenomenalism. It is perfectly open to us to hold that the mind does not act on the body but that mental states are a joint product of certain bodily processes and of past mental states. And there is no reason whatever why certain mental states should not have purely mental causes.

We have now seen what are the consequences of the hypothesis that all changes in the human body take place

in accordance with purely physico-chemical laws and have purely material causes. We must now ask whether there is any reason to suppose that this hypothesis is true. First we must notice that, since this conclusion does not follow from the conservation of energy, the evidence for the truth of that law in general, and the experiments which tend to show that the human body and its surroundings form a closed energetic system, have no bearing whatever on the question whether the human body is a purely physico-chemical system. Secondly we must notice that it might be true that the human body is not a purely physico-chemical system, and yet that the vast majority of the processes in it proceed in accordance with purely physico-chemical laws.

If the mind acts on the body at all it is pretty certain that it does not as a rule act directly on most parts of the body. If it acts on the body at all it acts presumably on certain parts of the brain and determines when and to what extent a transformation of energy shall occur there. All the subsequent consequences of this transformation in all the other parts of the body might proceed in accordance with purely physico-chemical laws, and of course all the bodily changes whether started mentally or materially might obey the conservation of energy. It follows that even if all physiologists were agreed (as I understand they are not) in holding that every bodily process that they had investigated took place in accordance with physico-chemical laws it would not in the least follow that none of these processes are started in the brain by the action of the mind.

When we remember the extreme difficulty of proving a negative about any thing, the extreme complexity of the human body, and the impossibility of accurately determining the details of minute processes in the brain of living beings, we may fairly assert that there is no prospect whatever of a direct experimental proof that every process in a living human body proceeds from beginning to end from

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purely material causes and in accordance with purely physico-chemical laws. Now when a hypothesis cannot be proved or refuted by direct experiment our only course is to consider what will follow if it is true. No hypothesis can be more probable than its logical consequences; hence, if the logical consequences of a hypothesis be wildly improbable we must conclude that the hypothesis is itself wildly improbable. Now the logical consequence of the hypothesis that the body is a purely physico-chemical system is that all its actions would be precisely the same whether it were accompanied by a mind or not. We have already seen that, when this suggestion is considered in detail, it is so wildly improbable as to be ludicrous. Hence I conclude that the view that the human body is a purely physico-chemical system is preposterous, and therefore that there is no reason to suppose that the mind does not act from time to time on the body.

I cannot however leave this point without saying something about the "enlightened parallelist" who figures in Chapter III, § 6, of Professor Stout's *Manual of Psychology* (third edition). Stout, who himself inclines to accept the arguments against interaction, admits that if the denial of interaction led to such absurd results as we have indicated, he would be forced to reject parallelism. But he thinks that they need not lead to any such absurdities. I will quote his example of the enlightened parallelist's treatment of the writing of *Hamlet*. "The manuscript may be regarded from two points of view, each taking account of only one aspect of its nature. In the first place, it may be regarded merely as one portion of matter among others.... From this point of view its existence can be accounted for through merely material conditions including especially certain occurrences in.... Shakespeare's brain. But the manuscript is not merely a material thing; it is also the manuscript of a play to be read, acted, and criticized. From

this point of view explanation in terms of material conditions certainly breaks down. What is essential here is the mind, not the brain, of Shakespeare; what is essential is Shakespeare as a subject, thinking, feeling, willing and adapting means to ends.... Whether we adhere to.... parallelism or to.... interaction, this teleological point of view remains unaffected."

The weakness of this passage is that it starts by professing to tell us how the enlightened parallelist will "account for the production of the manuscript of *Hamlet*." But it actually tells us nothing of the kind. It tells us what any enlightened person must recognize as the distinctive peculiarity of such material objects as manuscripts (viz., that they have a meaning and design). It does not in the least tell us how the enlightened parallelist can account, *qua* parallelist, for what he has to admit, *qua* enlightened.

But we may go further than this. Does Professor Stout mean that Shakespeare's brain and other material causes brought about the particular collection of marks on paper which constitute the manuscript of Hamlet, and that Shakespeare's mind caused the meaning of this collection of marks without affecting his body? Let us consider in what sense you can be said to cause the meaning of a set of marks. Unless a man is making up for himself a new language or symbolism there seems to be only one sense in which he can cause the meaning of a collection of marks. And the sense is this. Certain collections have, independently of him, a meaning for those who see them; and others do not. Of the former, some have, independently again of him, one meaning; and some have another. The only way in which he can cause a meaning is by causing the particular collection of marks that have that meaning. The only way in which he can do this is by the appropriate use of his body. And the only way in which he can appropriately use his body for this purpose is through his

mind thinking of the meaning and causing his body to make the movements which cause the collection of marks that express this meaning. Unless the thoughts and desires of the mind can affect the movements of the body I fail altogether to see how an intentional meaning can be expressed by any material object which is produced by the movements of the body.

So far as I can see the least that an enlightened parallelist could hold would be somewhat as follows: (1) All material systems and their changes have purely material causes. (2) Of material systems some are marked off from the rest by showing traces of meaning or design. (3) Somewhere among the material causes of such peculiar material systems will be a state or states of some one's brain. (4) With this state or these states will always be correlated in some one's mind a thought of the meaning and a desire for its expression.

Such a view seems possible, even if not plausible. But it would still leave parallelism powerless to explain the causes of our sensations. I think therefore that one-sided interaction of body or mind would always be in a stronger position than parallelism. For (*a*) it can give the usual explanation of the causes of our sensations. (*b*) It is, as we have seen, perfectly compatible even with the view that the body is a purely physico-chemical system. (*c*) With regard to the causation of material objects which show traces of meaning or design it could take practically the same view as I have ascribed to a really enlightened parallelist. The only modification would be that for (4) in the enlightened parallelist's position it would substitute the proposition: This state or these states of brain *cause* in the mind connected with this brain a thought of the meaning and a desire for its expression.

Mr. Russell argues in his *Lowell Lectures* that when we once understand that causation is nothing but functional

correlation we can see that the quarrel between an interactionist and an enlightened parallelist is largely a matter of words. On this assumption as to the meaning of causation it will at any rate follow that if parallelism be true so is interactionism. If we hold that there is a one-to-one correlation between the states of our brain and the states of our minds, and a one-to-one correlation between the states of our brains and the changes in the physical world which we say that these produce, then there will be a one-to-one correlation between our states of mind and the changes in the physical world. And if causation means nothing but such correlation then we have as much right to say that our states of mind cause the changes in the physical world as that our states of brain do so, or that our states of mind cause our states of brain and that these cause the changes in the physical world.

But, in the first place, I am very doubtful whether functional correlation be the whole of what we mean by causation. This, however, is not the place to embark on this wide inquiry. Secondly, even on Russell's theory of causation, interaction would not imply parallelism. E. g., there might be two bodily states which, as such, were indistinguishable in their qualities. To one there might be correlated a state of mind and to the other no state of mind. Now if we found that the first was correlated with a different kind of change in physical objects from that which is correlated with the second we could say that the state of mind is an essential part of the cause of changes of the first kind. Hence the question at issue between parallelists and interactionists will still be a real one.

It remains to notice a second scientific argument, drawn from the constitution of the nervous system, which is supposed to prove or render it probable that all bodily processes are purely physico-chemical, and hence that mind and body do not interact. If you take a purely reflex action, which

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may go on without consciousness, the arrangement of the part of the nervous system involved is that the afferent nerves convey the stimulus from the surface of the body and are connected with efferent nerves which convey a corresponding stimulus to the muscles. The two nerves join, or at least come into very close contact, at some place called a *synapsis*; and it looks as if the whole process consisted in some physical or chemical change being started by the external stimulus, pushing along the afferent nerve, affecting the efferent nerve through the synapsis, and producing in it a physical or chemical change which travels along this to a muscle and causes it to contract. There is no stage in such a process when it is necessary or reasonable to invoke anything but physical or chemical causes and laws. Now, it is said, all the nervous mechanism of the body, whether it be associated with mere reflex action or with apparent control of acts by consciousness is of the same type as the reflex arc. It simply consists of an enormous complication of such arcs, so that when a process of change once starts to travel along an afferent nerve there is an immense variety of different possible efferent nerves along which it may travel back to the surface of the body. Hence a single stimulus may be followed by an immense variety of external actions on different occasions. But, it is argued, we do not here have anything qualitatively different from the simple reflex arc, the only difference is one of complication. Hence if we did not need to assume anything but physico-chemical causes at any stage in a simple reflex action there can be no need to assume anything else in the most complex voluntary action. The different actions that follow at different times from the same stimulus will depend on the different resistance at different times of the various *synapses*; but there is no reason to suppose that these variations in resistance are due to aught but physico-chemical causes. If mind and

body really interacted, it is said, we should expect to find that certain afferent nerves ended in a kind of blank space in the brain and certain efferent nerves started from the same space. Then we might suppose that a stimulus reaching one end of an afferent nerve would affect the mind and that the mind by its voluntary decision would affect the end of an efferent nerve and thus start a nervous current down it which would finally cause a voluntary movement. Now we do not find any such arrangement as this in the nervous system; hence, it is argued, we may conclude that the mind does not intervene at any stage of the process.

It seems to me that, of these two arguments, which generally appear together, the second is quite worthless, while the first does indeed prove something, though not what its employers suppose it to prove. I call the second worthless because it practically assumes that, if at any point there is a gap in a process of purely physical causation, then must there be a spatial discontinuity, and the mind, in order to act, must somehow be in this gap as a wire has to fill up the gap between a bell-handle and a bell if the former is to ring the latter. Now this assumption simply rests on lack of imagination and abuse of spatial metaphors. When we say that somewhere in a process there is a gap in purely physico-chemical causation we simply mean that at some stage of the process an event occurs which cannot be explained by purely physico-chemical laws. It is obviously unnecessary to suppose that at this stage there must also be a gap or breach of spatial continuity in the process. So far the argument consists in confusing two senses of gap (i) a gap in an explanation, (ii) a gap in space. You must just as well argue that only persons over six feet in height can have high moral characters.

The other confusion consists in supposing that if a mind acts on things in space it must itself occupy a particular

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portion of space. That is simply due to lack of imagination. We are most accustomed to deal with the actions of things which have definite shapes, sizes, and positions; hence we are inclined to think that all things that act must have these characteristics. The inhabitants of Central Africa had just as good reasons for supposing that all men are black.

The first argument, on the other hand, does, I think, strongly suggest what kind of action the mind has on the body, but does not suggest that it has none at all. It strongly suggests that when the mind acts on the body what it does is to raise the resistance of some *synapses* and lower the resistance of others. It is probable that the resistance of *synapses* has causes which are partly physico-chemical and partly mental, that they may get into a state in which the mind cannot affect them, and that very often the mind does not affect them even though it could. In purely reflex actions it is possible that the mind has no control; in habitual actions which we can control but do not as a rule trouble to control, the non-physical cause is in abeyance; in habitual actions which have got beyond the control of the will the mind has lost its power of interfering with the chemico-physical process. This much the facts about the nervous system do render highly probable. That they do not render it probable that the mind has no control in any case seems to me to result from the following considerations.

The argument that the whole of our nervous processes are of the same type as those which accompany purely reflex actions cuts both ways. Whatever be the similarity in the nervous mechanism it cannot be denied that there is a clear introspective difference between the experience of a purely reflex act, like blinking when something approaches our eye or sneezing when we smell pepper, and a voluntary act, like deciding with difficulty to get out of a warm bath on a cold day. This is a real difference open to any one's inspection. Moreover it is a *qualitative* difference and not

a merely quantitative one; the experience of voluntary decision is not simply a mass of experiences of reflex action. Now this qualitative distinction has to be explained somehow; and the more you insist that the whole nervous system differs only quantitatively by its greater complexity from the simple reflex arc the more difficult it becomes to explain the admitted qualitative difference in the two experiences. If then it be certain that the structure of all parts of the nervous system differs only quantitatively from that of the part which is associated with reflex action we seem forced to suppose that there must be some difference, not of structure but of process, in the part associated with voluntary action. And in view of the evidence from daily life that the mind does act on the body in volition it seems reasonable to suppose that this difference consists in the fact that certain processes in the higher nervous system are not entirely physico-chemical. The facts, then, so far from proving that the body is a purely physico-chemical system and that the mind cannot act on it, rather tend in the opposite direction.

We may now sum up our results. (1) The most probable theory is that the mind sometimes acts on the body and the body sometimes acts on the mind. We have evidence for this of the same kind and the same amount as for any other case of causation. None of the objections to it are anything like conclusive, and all alternative theories lead to wildly improbable conclusions. (2) It is probable that in acting on the body the mind does not alter the total energy of the body but only determines in certain cases when and to what extent it shall be transformed. (3) It is probable that in voluntary action the mind affects the body by modifying the resistance of certain synapses. (4) The view that the body is a purely physico-chemical system does not follow from the conservation of energy, and can neither be proved nor disproved by direct experi-

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ment. If it were true it would still be possible and reasonable to hold that the body can act on the mind. The reason for thinking that it is not true is that it leads to the conclusion that the body would behave in precisely the same way if it had no mind connected with it, and that this seems most improbable. (5) The arguments based on the structure of the nervous system are partly mere confusions and prejudices. They have no tendency to show that the mind cannot act on the body; but, when all the facts are taken into account, they tend to make it probable that the mind does act on the body. (6) The most foolish of all theories as to the relation of body and minds seems to be epiphenomenalism; next to it comes parallelism, the doctrine that all which goes on in the body is determined by purely bodily causes, that all that goes on in the mind is determined by purely mental causes, and yet that there is a mysterious correlation between events in one series and events in the other.

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IN REPLY TO DUALISTIC CONCEPTIONS OF MIND.

HOW attractive is the idea of "Mind the Creator of Matter"! In a certain sense the theory is old, as old as religion, as old as mankind, as old as the first dawn of civilization, for mind has been considered the creator of the whole world; God is the creator and God has been assumed to be mind in the narrowest sense of the word.

The present number of *The Monist* contains an article under this caption by L. L. Pimenoff, who here presents the proposition of "mind the creator of matter" in a still more specific sense. It is not only the old idea that God created the world in the Biblical sense, "And God said 'Let there be light' and there was light," but the statement is meant in a new sense based upon the latest theories of psychical research. According to these mind is a kind of cerebral battery which sends out electric waves, and these waves have the faculty of creating matter in the sense, not that matter is made out of nothing, but that ether is transformed into tangible and gravitating mass. The author corroborates the proposition by quoting a number of authorities, some of them of scientific repute such as Oliver Lodge and Crookes, but I doubt very much whether their depositions will find credit among scientists of the normal and average stamp who are not affected by psychic theories and by a belief in extraordinary experiences of psychically abnormal people.

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The subject presented is one of great interest, and if it contains a mere inkling of truth it would certainly be of enormous importance to the human race, for in that case matter of all kinds, including the most necessary nourishment, could be produced by pure thought. A person in need would have simply to concentrate his mind on the materials he wanted and could thus easily appease his hunger or thirst in a most satisfactory manner. There would no longer be any attempts made to starve whole nations into submission, but the psychical men could produce without great effort the things needed for the sustenance of their comrades and families.

The theory of "mind the creator of matter" as we find it in the Bible is extremely old. All heathen mythologies contain stories in which the gods produce the world, or certain parts of the world, with great ease and by the mere power either of the word or of mental faculties. The word plays an important part in Egyptian mythology, and it almost seems as if the theory of the Logos as proposed first in neo-Platonism and then in the Gospel according to St. John was ultimately derived from Egyptian sources, but even the crudest mythologies make the gods or some god, or if they have already developed into a monotheistic belief, the one sole God, shape the world in one way or another, and so it is natural that a thinking being starts his theories with the idea that mind is the primary factor in the theory of existence. Other religions, those of ancient Babylon, India, Assyria, Persia and China, developed on parallel lines.

The theory of mind as the creator of the world received its first shock when science originated, and wherever we can watch that process we find that a more materialistic theory is substituted. We see mind develop in children. We see first the material bodily existence, and the mind develops gradually, first as mere sentient life

endowed with feeling and desire, and then from sentiency mentality is gradually developed until a state of maturity is reached in which thought becomes dominant, and in that phase we speak of mind. Thus mind is the final product of a process which we can observe in every growing being.

It is a new-fangled theory to look upon mind as a kind of dynamo or an electric motor which sends out waves that can be utilized for a physical purpose. The new theory originated with people who start with an exaggerated notion of the significance of spiritual factors, but after all it seems to us that they propose theories that are extremely materialistic. They misunderstand the nature of mind and intellectual functions and render them physical like the activities of mechanical machinery.

Whatever mind may be—whether a mechanical machine that attends to the process of thinking, or some mysterious agency of a spiritual character—it is certainly the most important fact that we meet with in our experience, for it is mind that dominates all our affairs and makes man a rational and thinking being. It is the scepter of man's dominion on earth, and it alone is the quality which endows him with his superiority among other creatures by giving him the faculty of foreseeing coming events, anticipating dangers and adjusting himself to his surroundings.

Mind has risen into existence in living organisms, and we are sure that it did not exist when the earth was still in its primitive condition, uninhabited and uninhabitable, before its crust had cooled down into a state that made plant and animal life possible. Nothing is more certain than this: First the earth was in a fiery state like that of our sun; gradually the planet cooled down and formed a crust on which the watery element covered the greater part of it, and the *terra firma* constituted the place on which life could develop in a regular evolution, reaching higher and higher planes of being. The characteristic feature of

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higher and lower is determined by the mental stage which has been reached and attains its highest development in man. So there was a time when there existed no mind on earth, and now the earth is peopled with intelligent beings that have evolved in a gradual and regular course of improvement. To the scientist the question is not how mind can produce matter, but how matter can develop from a crude state of mindless existence into a better and higher condition governed by mind.

Thus not the origin of matter from mind is a problem of science, but the origin of mind from matter; and to state briefly the outcome of it, we must insist that both mind and feeling have been declared not to be matter, or of matter, nor possibly to have been derived from matter as one of its qualities, but mind must be something *sui generis*. Mental phenomena are subjective, while motions and actions of matter are objective, and the solution of this problem has been briefly the statement that all subjectivity, including mental actions, constitute one side of existence while material existence is the other; or in other words existence is possessed of an inside and an outside. It presents itself as an objective existence by being matter in motion, but in itself it is neither matter nor motion but feeling, and this theory first clearly formulated by Fechner is commonly called the theory of parallelism.

According to the theory of parallelism, matter and feeling are different. Feeling does not originate from matter nor from energy, but is radically different. It is assumed to accompany, according to form, the different motions of a living body, and different motions in the nervous system of living beings are accompanied by different forms of feeling. These two sides of existence, the mechanical or objective and the sentient or subjective, are as different from each other as a concave or inside curve and the convex or outside curve of a circle. They have a definite

correspondence but are different in their very characteristic qualities. The totality of subjective phenomena in its continuous existence is called soul.

If the soul cannot have been produced by matter it must have evolved together with matter as its inside existence, and this inside existence is trying to gain the superiority and take the lead as a central dominance of the whole. Assuming that certain motions are in themselves feelings we will understand how these feelings develop into broader and deeper consciousness. The subjective feature of unorganized nature, often called dead or inert matter, is not such that it can be characterized as being possessed of actual feeling, but assuming that the subjective side of matter exists throughout the world everything existent is possessed of subjectivity or the potential conditions from which feelings develop, and if we ask how such a change of potential feelings into actual feelings may come about, my answer would be, by organization. It is not sufficient for a feeling to be actual consciousness. The feeling must gain clearness to be a real feeling, and that is possible only by organization. An isolated feeling is not actual feeling, it is merely potential feeling. A feeling to become an actual feeling must be interrelated with other feelings. It must feel and be felt. It must be so interlinked with other feelings that one feeling feels the other feeling, and can gain clearness by a contrast with other feelings. Such a process would be called organization, and at any rate it is a fact that sentient life originates only in organisms which are living beings in which sentient parts are interrelated and organized.

Such we may fairly well claim to be the established facts of the origin of feeling from a world endowed throughout with subjectivity, which involves a possibility of developing feeling and may be considered as the inside nature of all existence. The next question is how feeling

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as it has developed in sentient matter will develop mind, and we may briefly answer this problem with the following considerations. A sentient organism is exposed to all kinds of impressions, such as touch, light, sound waves, etc. These impressions are of the same kind and have continued to affect organisms from the beginning of their birth, and the results of these impressions have affected the organism in such a way that their repeated occurrence has created organs for their reception. The impressions of touch have affected the outside of the body in an outer membrane called the skin, and the skin is so arranged as to receive impressions of touch in a way that they are felt to represent something outside. Air waves come upon the body in a similar way as the impressions of touch, but in a special place an organ is produced which we call the ear, ready to receive these air waves so that they may be incorporated into highly specialized feelings called sounds, and every such feeling of sound is so highly specialized that sentient organisms have different feelings for each different sound, and these feelings so differentiated begin to represent the different sounds so as to become identified with them. The same is true of the impressions which ether waves make. A special organ is formed which we call the eye, and the highly complicated process of seeing has finally made the eye as it is to-day in living beings, animals as well as man.

The eye is so differentiated that a living creature receives through the ether waves impressions which produce definite pictures, and these pictures represent the bodies from which they come. The process of seeing has become so natural to all living creatures that they do not reflect about its nature and origin but simply take the result as a fact of their existence. We see things and animals and all kinds of objects in our surroundings and adapt them to represent the things themselves as given data of our experience. While the light emanating from objects of our surround-

ings impresses pictures on our retina we take the pictures as facts and say that we see those things as if our pictures were the realities themselves. Considering all in all we find that sense-impressions are made upon organisms and that these sense-impressions by constant repetition become representative, and we may boldly say that representativeness is the character of mind. We have sensations, and these sensations picture the world of our surroundings and by showing them with analogous descriptive details they become symbols and furnish us with the material out of which we construct our views of the world.

The next question is the perfection of man, or the origin of human reason, and that coincides with the origin and introduction of speech. By speaking an animal learns to think in abstract terms which puts life on a higher plane. Reason enables us to think, foresee and adapt ourselves to conditions and to understand better the significance of life; in other words, to think scientifically and to raise consciousness to a higher plane, commonly called self-consciousness. How does this come about? How is it possible that mere animal life can develop into rational or human thought? The answer is this, that it comes about in the normal course of events by repetition and by a continued and higher organization. The same impression follows the same nervous tracts by which it is carried to the same central place in the brain. There it is impressed into a structure which has been formed by the same kind of impressions made by the same kind of object in former experiences. The whole structure thus forms a kind of composite picture, and this composite picture melts into one and is accompanied by an oral expression which denotes the whole. The origin of reason is the origin of language. Man thinks because he speaks. He has learned to think by self-observation through an analysis of his way of thinking.

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I will not enter into the origin of language, which has been treated by Ludwig Noiré and also by Max Müller, but I will state here that the speaking animal develops a certain sound to accompany the definite picture of a certain object. Seeing a cat or a horse or a dog we denote all the recollections of cats or dogs or horses with the words, and thus the names instigate and stimulate our recollections of these several animals. They become a kind of label and, as all our mental impressions are registered according to our notions of them in a systematic way, our new sense-impressions run along the tracks of former nervous impressions of the same kind. The brain originates like a store house where different sense-impressions are regularly stored according to their nature, and we thus see that in the develepment of mental arrangements a logical system originates in which species become subdivisions of genera. In this way of systematically registering our sense-impressions according to the principle that the same impression goes to the same place prepared for it by former impressions, we develope a logical arrangement of mentality that prepares us to think clearly and helps us to find ourselves prepared for a logical consideration of our own experience when we reach the scientific method of self-observation.

One mind can exchange thoughts with other minds by using the same kind of symbols and speaking the same language. We understand each other because the same words denote the same objects and the interconnection of words expressed in endings and conjunctions will explain to us the relation in which the words stand to each other. All is grown by nature through the impressions of the surrounding world and thought and observation of their interrelationship. It is the symbolical nature of thought which makes mind useful, and if there is any telepathy such as exists in telegraphy it is in sending out by the quickest pos-

sible means (among which electric currents are the most efficient) certain shocks transmitted and so charged as to have definite meanings, and these meanings are understood by the recipient party in the same sense as they are given out by the sender of the telegram. Here again we find that the nature of mind remains representative. We must know that certain impressions, be they dots or dashes or any kind of shocks sent out, represent definite thought and that both parties possess the key to understand them. If mind produces anything it produces definite impressions by any kind of means, sound-waves or electric waves or what not, but always a definite form of a wave must possess a definite meaning. Thus mind is not any mysterious quality of unknown psychical or mental or spiritual waves, but it is produced by the transmission of physical impressions by means of the spoken word or otherwise, and we have not the slightest notion in spite of all the learned believers in the mystic ability of the mind that mind produces any other effects, such as the consolidation of ether into matter, or the change of one chemical element into another, or that there are waves going out from the brain of man possessed with any supernatural or unnatural or hyperphysical faculties.

Considering what science knows about the soul of man, I should say *a priori* that such inventions as are mentioned in the article "Mind the Creator of Matter" are highly improbable, and I would therefore naturally refuse to believe them until they are proved beyond doubt. The strange facts mentioned are interesting enough in so far as they are accepted and considered believable by the author who presents them, and also by the men of science to whom they are attributed. Let us wait until they are verified and hold ourselves open to conviction either way, to accept them if they unqualifiedly can be proved, or to reject them if they remain doubtful or can be proved to be untrue by having

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been due to misrepresentation or misconceptions of some kind.

It is a nice picture of the potentialities of mind to think that it possesses qualities which would make it divine and a real child of God, the creator. Yet even in this we should say that such a conception is not without a deeper meaning, for mind being the product of organization may truly be said to be the creator of matter if we think of matter as being the product of organization. If this principle may be considered as the prototype on which mind has been formed we may consider it a kind of original mind or protomentality, and such a condition is exactly the faculty of making something by combinations. This would be the divinity that pervades the world and its creative faculty, and in so far we could again justify the old proposition that God has made the world; or, in other words, the theory would be justified that mind—not the human mind but the superhuman or divine mind, the principle of organization —has shaped matter from the aboriginal material of ether into the different elements as we see them develop according to their masses on a definite grade of creation according to their weight and complexity. In this case, however, we would find our conception of God justified, which may be called in one word nomotheism, or the principle that natural law is the divine order according to which a chaos is impossible, that all nature develops according to law in a definite orderly way as it is realized in the course of evolution.

The proposition of our author, L. L. Pimenoff, can fairly be regarded as unacceptable to scientific thinkers, and we present it mainly as an interesting vagary of a fantastic theorist who—in the judgment of most scientists—will scarcely expect a serious indorsement of his proposition. In this same number we present an article by Mr. C. D. Broad whose expositions on the subject of "Body

and Mind" are of a very different character. He treats the problem of the interrelation of body and mind—but suffers from the misconception that body and mind are separate entities without explaining their character or their mode of intercommunication. But he criticises the current theory of parallelism.

Psychologists since Fechner's day have indeed assumed that feeling is not motion and motion is not feeling. Feeling cannot act as a link in causation, and causation must be a chain of events in which cause and effect are uninterrupted. The question therefore is, how does the mental activity enter in the chain of events? If feeling does not form a part of the chain it plays no part in causation and the mind cannot *ex principio* act on the body. This would be a simple conclusion from the abstract considerations that by feeling we do not understand matter or motion, and by matter or motion we do not understand feeling, otherwise we might follow Mr. Broad in thinking that the theory of parallelism is absurd.

We will therefore make a few remarks on the theory of parallelism which we hold to be true in spite of misrepresentation. In a series of events which act as causes and effects in a mental process it is necessary that step by step brain motions are followed by other brain motions, but some of the brain motions are accompanied by phases of feeling, representing mental acts of thought. Definite thoughts are the inside accompaniment of definite brain motions and the nature of thought depends on definite forms of brain structures. And this definite structure gives them the faculty of acting. The meaning of words or the mental aspect is not endowed with energy, but definite brain structures which are endowed with energy are possessed of meaning, and when their feeling is stirred thought originates and assumes in the mind a definite meaning accompanied by the commotion of its correspond-

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ing definite structure. It is this brain motion which forms a chain in the causation and here is the point at which mind actually acts on body.

It is not the mind itself or the feeling which is present in our mind that forms a link in the chain of causation, but it is the energized nerve which stirs the brain and acts as the causal link. It is not impossible that by some diseased condition the nerve fails to act, and in that case there may be a state of will without the ability to execute it—a disease described by Ribot under the name *aboulia.*

Thus a critique of the theory of parallelism may become a verbal quibble. If we understand by mind merely the subjective side we could speak of the inability of mind or of feeling to act on the body, but if we understand by mind not only the subjective aspect of a mental process but also the bodily commotion of the brain which it ensouls, we would have to say that there is no question but that the mind influences the body. We must not lose sight of the fact that feeling is a mere abstraction, and if by this abstraction we mean only the subjective side of a process, only the mere actual feeling to the exclusion of its physical condition or accompaniment, it would naturally be illogical to make it the efficient cause in the chain of causation. But if we include in feeling its bodily condition we naturally include the physiological activity which is freighted with energy and forms a link in the chain of cerebral causation.

Mr. Broad certainly does not present a theory of his own which would be acceptable, or give us a satisfactory explanation as to the nature of mind. No! He leaves us in the dark as to what the mind really is or can be, and for all I can see in his proposition, the mind is a mysterious creation of a dualistic conception which is endowed with several mysterious qualities, acting on bodily forces in an unaccountable way.

According to Fechner feeling does not act on mind,

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because motions only can be the causes in a chain of causation; what is not mechanical cannot produce an effect, for causation is mechanical. Feeling is different from mechanical action, but it is inefficient not because it is different, but because it is not motion. In order to be a cause, or a link in the chain of causation, it must move or push in order to produce a change of any kind. If the feeling in its narrowest meaning cannot stir motions in the brain, the accompanying brain motion may or probably will do it. In bearing this in mind we find no contradiction in the theory of parallelism.

Mr. Broad favors a "two-sided interactionism" in which "the mind sometimes acts on the body and the body sometimes acts on the mind." He condemns epiphenomenalism, according to which feeling is an epiphenomenon or superadded feature standing outside the regular normal causation of physico-chemical activity. Next in foolishness to this theory he regards parallelism. He claims with great insistence that the body is not a purely physical and chemical system, and in this latter point we can agree fully and without any reservation, for in the scale of natural phenomena we have a domain of purely physical and chemical phenomena and while some scientists assume that vital processes are purely physical and chemical we cannot deny that psychical transactions possess a feature that cannot be regarded as physical or chemical, but possesses something that is absolutely new.

If rightly understood there can be no quarrel on this point, and we fully agree that the influence of psychical items does make a difference in the chain of causation. If it is not the feeling portion of a telegram which makes a man jump from his seat and rush into action, it is the meaning of it which meets with an understanding of a threatening danger or whatever it may be, and this meaning is conveyed by the form of letters, which according to

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former education possess a definite meaning. The forms of certain words together with the meaning with which they are endowed constitute the factor which causes the reaction and sets energy free, just as a key unlocks the bolts through the arrangement of its wards and it opens the lock on account of the shape of its indentations which fit into the corresponding shape of the lock. It is this correspondence of the meaning of words or of symbols which makes the psychical portion of interrelated events efficient, and it is this fittingness, this correspondence, not exactly the pressure and the energy, which constitutes the significance of spirituality. Thus we might very well say that it is not the energy or pressure of the key that opens the lock, but it is the very form, the singular complexity of its wards which in the Yale lock is reduced to a curve on the stem of the key. The mechanical pressure of the key as well as of the nerve is the moving power that is indispensable in the chain of causation, but the correspondence of the meaning of words determines an action in the same way as the proper key opens the lock into which it fits.

Thus it is seen that in judging of the theory of parallelism we must first of all understand its meaning and not confuse its issues. It is to be feared that Mr. Broad construes a parallelism of his own and condemns it on the ground of a misrepresentation which is either misconstrued or possibly a wrong presentation. At any rate it seems to me that Mr. Broad's criticism does not upset or invalidate the theory of parallelism, which so far as can be seen is the only one on which a monistic theory of the interaction of body and mind can be constructed.

EDITOR.

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A PSYCHOLOGICAL VIEW OF THE PRAGMATIC ISSUE.

PROFESSIONAL philosophers have published many volumes trying to solve the problem, whether our ideas of things are true because they work or whether they work because they are true. To my mind the realities of life, and of acquiring knowledge, present no such issue, and the discussion of it has had its chief utility as a necessary step toward the discovery of its futility, and so contributing one factor to our understanding of intellectual evolution. To exhibit my justification for this belief is the reason for this essay. Incidentally it may appear that by adopting the first of these formulas to the exclusion of the second one some pragmatists are guilty of that same absolutism for which they so generously criticise others.

Here as everywhere we must seek the solution of our problem on the basis of a higher intellectual level than that on which it arose. Thus the desire for more efficient observation and a more inclusive synthesis of the factors of the problem will lead us to re-examine the seemingly conflicting formulas with the view of translating them into concepts of behavioristic psychology. From this new viewpoint perhaps we will see the old formulas as presenting mere incomplete and dissociated aspects of the same cognitive process. From this psychologic aspect we may also achieve such an integration as will rid us of our seeming conflict.

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The statement of a common premise will be followed by a brief analytic restatement of some of the behavioristic aspects of acquiring knowledge in so far as these seem material to the succeeding discussion. After that will come a statement of the synthetic view, and a psycho-analytic suggestion as to the probable cause, conducing to the past dissociated consideration of these intimately related formulas.

As a common premise for my discussion I assume that the limitations of our thinking faculties are such that we cannot know things in themselves, but only some incomplete and imperfect aspects of things. For the future discussion it is important to bear in mind that the belief in the impossibility of knowing things in themselves rests in part upon the fact that to know things in themselves seems to involve what is supposedly an impossible identity of the arbitrarily distinguished knowing mind and the things known.

This being true, we acquire only some incomplete views of some aspects of objective reality, by becoming conscious of an affect-producing relationship therewith. It then seems that all that any of us think we know, must embody some imperfect aspect of things, and must always hold, at least, some tiny resemblance to truth. From this viewpoint of a contrast between the thing known and the knowing mind, perhaps our conception of a thing can never be an exact transcript of objective reality, because to be that it must also become identical with it, yet being derived from a relation with realities, or being some crude awareness of such related existence, it cannot be absolutely false. Since we cannot yet see intelligence imminent in things, nor in the relation among things, it follows that our conception of things, which is an imperfect understanding of their behavior in and during changing relationships, attains varying degrees of approach to identity with, or to an exact transcript of such relation with and between "objec-

tives." The evolutionary rating of this growing intelligence depends upon the diversity, number and complexity of the aspects of things and their relationships which have entered into our affect-objects, that is, of which we have become aware and which we have coordinated in our awareness, and synthetized in the shaping of our concepts. This is only a behavioristic and descriptive way of saying that we grow toward a perfect accuracy of concepts as transcripts of things and of the relationships of these, according to the efficiency and extent of our observations and the relative completeness of their coordinations.

From this we conclude that no concept is wholly false, and that the only judgments which should be passed upon concepts are those which express an evolutionary classification according to relative degrees of approach toward the completeness of our awareness of things (behavioristically identified) in the first place, a relation mong things in the next place, and our relationship to things and to inter-objective relations. All are essential to an exact transcript of reality. These also measure roughly the degrees to which our intelligence is removed away from the mere intellectualization of desire.

The progressing refinement and completeness of our concepts depends in the first place upon our efficiency as observers. This efficiency in turn depends upon the kind of sense-organs which we possess; the degree to which they are educated and developed toward and by means of extraverted interests; the extent to which our sense-organs are supplemented by mechanical contrivances, the quantity and complexity of previously related material which is available and is coordinated in each present observation and judgment; and lastly the number of behavioristic relationships, and the degree of complexity and remoteness of these, which are coordinated within each last concept. It is this stored material of past experience which determines

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the multiplicity and complexity of the conditions which we can and do prescribe for testing the workability of each present theory of things. So then, we judge relative degrees in the perfection of our conception of things and their relationships, by the relative degrees of multiplicity, variety and complexity of the conditions under which the test of workability is applied. (For further discussion of this evolutionary classification see my article on "Intellectual Evolution and Pragmatism," in *The Monist,* January, 1916. There I also describe, yet too briefly, my concept of the affect-object.)

From this brief description of evolution in the knowing process it seems to me clear that two, purely hypothetical, extreme propositions have become apparent. For the first, we may assume a person without any previous acquaintance with the workability of any idea. In such a hypothetical individual, if thought were possisble, it would be a pure intellectualization of desire. In this hypothetical case, there would be no possible way for such a person to decide whether his first claim of truth contained any portion of the true aspects of objectives, except by the present or future test of workability. From such a view-point, manifestly *such a being,* bereft of all experience, can *only* say that the "concepts" (desires) contain a measure of truth, in so far as thereafter they can be made to work. Having no other experience or prior concept, nor any general concept capable of a deductive application, it cannot be otherwise than that for such a person the first concept would seem true only *because* it works, and later *so far as* it works.

The second proposition which seems to me equally self-evident is this: Let us assume that our conception of things had attained the impossible perfection; that it has become an exact transcript of objective reality, which is only another way of saying that the knowing intelligence is found

imminent in, and so far identical with, the things and relations known. In this situation, there could be no possible failure of the test of workability. One having attained such a state of perfection could say "my ideas about things work *only because* they are true."

Of course no mere human is wholly in either of the hypothetical extremes which are involved in the foregoing propositions, and that is why the controversy under consideration is barren. According to our intellectual development we will see only one, or will emphasize one or the other, of these formulas born of an inefficient observation inducing believe in an impossible extreme situation.

Even in earliest infancy it cannot be said that we are wholly void of experiencial knowledge. Likewise we never attain such intellectual maturity that our concepts are accurate and complete transcripts of any objective realities. Intellectual life, in the sense of continuous change, is in a constant flux between these two extremes. In relative immaturity our concepts are mainly the intellectualization of desires, with a minimum of the check of past or present tests of workability. Toward the other extreme, we approach to a situation where there is a maximum of the checking influence of past conscious and unconscious formations of affect-objects, which tend to be automatically and unconsciously applied.

So then, it is inevitably true that each of us is in an ever changing state of development between the infantile condition, where our concepts are entitled to presumptions of extremely slight correspondence with any objective, until after the conscious subjection to at least some simple test of workability; and that other stage of development, where our concepts may be so largely the products of the experiential checks upon infantile desires as tend toward the presumption that they will work because they approach relatively near to an exact transcript of the realities.

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So then from this point of view, of a changing and growing mind, in an ever changing relationship with equally changing objectives which are undergoing changes in interobjective relationships, we see that each of the seemingly conflicting formulas contains an imperfect aspect of relationships such as are at present incapable of even exact definitions, or complete separation. If studied with the desire to understand the behavior of human energy in the process of achieving knowledge, then the controversy under consideration looks like a mere war of words, because it does not describe a real conflict of forces, and so is not adequately related to any behavioristic study of such forces.

There are no concepts which are not somehow ultimately founded upon experiential relations with objectives, no matter how utterly void of that experience our conscious memory may be, nor how small the resemblance between the concept and the realities. However unconscious we are of the influence of that experience, the fact that we acquired the concept shows that at least a feeling confidence in its workability has been impressed upon us unawares, by the experiences themselves. Hence the existence of a corresponding assurance that the concept transcribes the reality with substantial accuracy even though we know nothing of the mechanism by which that feeling-conviction was engendered. We simply know because we feel and are firmly convinced in proportion as we are strongly agitated by desire.

So far we believe our concepts work because the experience upon which they are founded has left an impress like unto that of their having "worked"; that is to say, we have a desire that it shall be so and an accompanying feeling—a feeling-conviction—that it is so, and that conviction, were its source and mechanism to be verbally formulated, would be expressed as being warranted by pragmatic tests which had already been unconsciously applied. Before we

can consciously apply tests of workability we must have done a little generalizing, because the conscious application of pragmatic tests is partly a deductive process, even though at the moment we are unconscious of that aspect of it. To the extent that we *consiously* apply further tests of workability we find that the concepts work just so far as they are true. When we attain to a consciousness that we are making deductive application of general ideas, we tend to say our ideas work *because* they are true. As we see this, and coordinate it with our earlier exposition of the inductive aspect of this behavioristic psychology, we again come to the conclusion that there is no such conflict as is postulated in the pragmatic issue.

In the realities of acquiring knowledge both formulas are always actually and practically implicit. Persons who affirm that our ideas are true *only because* they work, are for the moment seeing only the inductive part of the process which perhaps is the first that we become conscious of in our individual development. That person who affirms that our ideas of things work *only because* they are true is seeing the complex intellectual behavior only in its deductive aspects, and is forgetting that sometimes our ideas seem to work because they are relatively false and the conditions of the applied pragmatic test are too simple to expose the error. When we acquire a synthetic view of the behavior of the human energy operative in the knowing process, we see the inductive and deductive methods proceed interdependently even in the unconscious activities. In the more highly developed states of conscious supervision over our intellectual processes, we carefully provide for the interaction and check of both methods. So we tend to become aware of the interaction of the modes of conduct presented by both the formulas in the pragmatic issue at the beginning of this essay. Each represents an incomplete aspect

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of the realities actually involved in the process of consciously developing intelligence.

If that is so, then why was there ever a philosophic issue made of it? I suspect it is because even philosophers have their unsolved personal problems—their subjective conflicts. In philosophers, as in children and hystericals, these conflicts, induced by a past thwarted integration, conduce to negativism, that is to the future dissociation of different aspects of the inspected realities, and so tend to inhibit and limit the larger synthetic understanding of their problems, including the philosophic ones.

If in infancy a future philosopher was habitually compelled to subordinate the method of his expenditure of energy to the authority of a parent instead of the arbitrament of "facts," he may easily grow to maturity of years with an emotional aversion to accepting things as they are, or their interpretation according to the accepted authorities, even in philosophy. If his own intellect is sufficiently fertile, he will see some aspects of things and of their relations, which his fellow philosophers have overlooked. If his aversion to "authority" is sufficiently strong, that aversion will preclude the coordinating of his new aspect with what is reconcilable to it, in that which is already accepted, and will tend to see the new only in dissociation, that is in its negating aspects, as a conflict with that which is already accepted. Thus probably grew the pragmatic controversy depicted in the first paragraph. The integrating process represents a relatively higher evolutionary level.

In this case the synthetic aspect of the mechanism of growing intelligence is missed by pragmatists who make a philosophic cult of one of these related formulas to the exclusion of the others. In consequence of this limitation upon their powers of coordination, they are impelled to frame up verbal defenses for their unintegrated aspects of

things, and such formulas as present the seeming conflict in the first paragraph of this essay are the result.

If now we re-read these formulas and coordinate them as different aspects of the behavior of human forces, it is easy to see that the apparent conflict of theory is due to inaccuracy of observation and statement, probably induced by the necessities of repressed emotional conflicts of the past, which have hitherto precluded, on the part of particular philosophers, efficient effort toward the coordination of the two formulas into a more complete understanding of these related psychologic factors.

THEODORE SCHROEDER.

NEW YORK CITY.

LUCRETIUS RETURNS.

A PHILOSOPHICAL POEM.

> "Now Philosophy is like unto a Garden, wherein upspring all manner of flowers and herbage, sweet of scent and potent to heal. And the Soul is like unto a Moth, leaving the cocoon of the Unconscious to flit through the twilight, seeking the Nectar of Life. Now within the Garden hovers the Soul amid the herbage and flowers, darkly swaying in the dim starlight and the shadow; hither and thither, drawn or repelled, lured by a remembered fragrance or driven back by an unfamiliar form that is but half revealed—thus the Soul wanders through the mysterious dusk of the Garden."—From *The Golden Scroll of Krotona.*

ETERNAL stars that heaven's hill bedew,
Ye looked upon the manger where Mankind
Lay wrapped in rags; ye heard the angels sing,
When royal Magi spread their gifts of myrrh
And frankincense upon a shabrack coarse;
Ye gleamed above the boy at merry play
In Nazareth, and wept at Golgotha—
Smiled on the resurrection, and, at last,
World-wounded, he ascended unto you.

Eternal stars that heaven's hill bedew,
Ye heard Creation's grand exordium—
The moan of seas in the azoic age,
The din of wood and jungle; then, anon,
The war-song of the savage fierce and free,
Grim troglodyte and fleet lacustrian;

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At last the pulse of forges and the roar
Of teeming cities—an aubade of joy,
Thrush-throated like the chant of cherubim.

Attend! Mine is no plaint of selfish woe:
Weeping o'er Niobe and Tantalus—
O'er Truth, o'er Justice, and o'er Liberty.

Tears shed for butchered Innocence, the blood
Clotted upon the lacerated back
Of Helotry, the virus from the fangs
Dript of dread hydras preying upon Man,
The sighs of sunless centuries, each curse
That livid lips of trodden Truth have framed,
Pour into Hate's alembic and distill
Into revenge—into a cup of gall
For Tyranny, in stupor gluttonous
Huddled on filthy couch. What of a world
Where Wrong is fattened, Folly wears the crown,
While Justice spreads her ermine over straw,
And Learning feeds upon the hedgerow haws?
Shame on humanity! I have known wights
Who daubed their cheeks as silly damsels do,
And strutted round with rings upon their hands,
Yet sat in senates where to counsel met
The sceptered wisdom of a mighty age.
I have seen gypsum hawked about the streets,
Figures of poets, by a man whose soul
Soared far in song above the paltry souls
Of those he modeled as the unpitying sun
Above his fevered head.

Is there a God
To mete our merits and adjudge our fails,
And could he be thus blind?

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The peopled sea
Hath coral castles through whose lurid aisles
White mermaids flash and hippocamps disport
Amid the sunken argosies of Time,
Patined with gold and crusted o'er with gems—
All these are thine, thou unborn Œdipus,
Who canst unveil the riddle of this Sphinx!

Yet, shall we say the rich, ripe fruit of Time
Fell from the womb of Chance? The dreams, fresh-
drawn
From lustral fountains by a naiad troop,
And borne like dew in lily chalices
To my lone couch, are witnesses that still
A spark survives of what the race hath been.
See yonder shadow cross the sun; observe
The stoop of Atlas; note the line of care
Which mars the brow of kings; or hear the shriek
Of the mad mænad War—can Glory be
Attained save by the thorny track of Woe?

The universe proclaims there is a God!
From tongueless chaos, lutulent and foul,
He culled the vying wonders that we view;
Scatters the violets upon the heath,
And paints the silken petals of the rose;
He bids the planets sing—aye, and he feeds
The adder's tooth with venom; strews the rocks
Upon the pathway of the mariner;
His whirlwinds filch what his beneficence
Hath lavished on the orchard and the farm;
Anguished we cry for light, and see the forked
Tongue of the tempest lick the midnight's brow.

Lo, now, what festering horrors feed our grief:

Beauty decays, Nobility is slain,
Sin sheds his larve, and curst Hypocrisy
Barters his whine and rheum for place and gold.
'T may be, if there's a Providence all-wise,
The far untraversed forest tracts were grown
That on the Judgment Day there might not be
Dearth of good gallows-timber on this globe.

Tiptoe, the twilight muses on the hill;—
Should it descend into the slumbering town
To gild the misery of the driven mob,
Or, fleeing to primeval solitudes,
Hold discourse with the laughing deities
Of hort and vale, caress the airy fern,
And court the sylvan calm upon the sward's
Pied flocculence, where, mean solicitude
Being banished, all the elder gods again
Resume their interrupted reign, to bid
Sorrow and Sin and Shame begone from earth.

Man must approach to God by purity,
E'en as the highest mountains, undefiled
By human footfall, where the virgin snow
Lies chaste and spotless 'neath the amorous sun,
Are nearest heaven.

Let us, too, be brave!
Canst thou bribe thunderstorms with honeyed words,
Or curb with sandhills the choleric sea?
Where Sorrow strikes, let honorable scars
Remain, the blazon of our fortitude.
Be not of such slight, puny courage as
To drink nepenthes, or that slumbrous juice
Of dream-compelling poppy; can there be
Virtue more potent in a wayside weed

Than in the trodden heart's tear-wine of hope?
What laurel for the soul if Vice be shorn
Of her allurement, or the sword of Sin
Be dulled by sorcery? Could a coward hear
The prating trump of Triumph, and become
Not brave? 'T may be there is no God; whence then
Proceed the whisperings that abjure ourselves?
Could the chill alchemy of atheism
Transmute one earthy atom of this race
To the rich metal of divinity?

Yea, there is One that walks in human hearts,
Sandaled with rose-leaves, and with gentle touch
Weeds out all malice; balm upon her lips,
She stoops to kiss the humblest flowering thing;
The sculptured lily she awakes to life,
Paints irised poems on the sterile rock,
And strows the sod with immortality.
She leads the orchestra of brook and breeze,
Of bird and bee, in symphonies that swell,
Dulcet adagios of a seraph choir,
Across the sobbing solitude. She smiles,
And Sorrow is no more—sojourning Grief
Shoulders his wallet and forsakes thy roof.
Her robes of gossamer in cirrous twills
Bear health and happiness upon their seam;
Touch this, and thou art whole! In her tranced eyes
The gorgeous gonfalon of Day unfolds;
And Peace, sweet child of life's lorn Enna, sleeps
Upon her bosom.

Have ye heard her name;
Knelt in her temples; walked among her groves?
Love that doth thrill the molecule to dance,
And string the cosmic lyre with golden stars—

Love that doth kiss the lids of Death ajar,
Enchantress of the demiurgic word,
Mother of men and genetrix of time—
At once the Law, the King, the Throne; at once
Doer and Deed, the Singer and the Song;
Breath of the gods that fills the lungs of space,
In which the suns are sparks of dust immerst;
The earliest Element and latest Form,
Orbit and Orb alike—immortal Love,
The promise and the potency of Life;
The gladness and the glory of the world!

GEORGE SEIBEL.

PITTSBURGH, PA.

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CRITICISMS AND DISCUSSIONS.

TIME AND SPACE.[1]

The conceptions of time and space which I wish to develop here have arisen on the basis of experimental physics. Therein lies their strength. Their tendency is radical. From now on space-in-itself and time-in-itself are destined to be reduced to shadows, and only a sort of union of the two will retain an independent existence.

I.

I wish first to show how from the mechanics now generally accepted we might arrive by purely mathematical considerations at a change in our ideas of space and time. The equations of Newton's mechanics show a double invariance. Their form is maintained, first, if we subject our system of original coordinates in space to any *change of position*; second, if we change its state of motion, that is to say, impart to it any uniform translation; neither does the zero-point of time play any part. We are accustomed to considering the axioms of geometry as settled before we approach the axioms of mechanics, and therefore these two invariances are seldom mentioned together. Each of them represents a certain group of transformations, which transform the differential equations of mechanics back into themselves. The existence of the first group is regarded as a fundamental property of space. It is usually preferred to treat the second group with contempt in order to

[1] Lecture delivered at the eightieth Congress of Naturalists at Cologne, September 21, 1908. Published in *Physikalische Zeitschrift*, X (1909, pp. 104-111, and *Jahresbericht der deutschen Mathematiker-Vereinigung*, Vol. XVIII, pp. 75-88; *Gesammelte Abhandlungen*, edited by D. Hilbert, pp. 431-444; also separately, Leipsic, B. G. Teubner, 1909. Translated from the German by Edward H. Carus who herewith expresses his gratitude to Prof. W. B. Smith of Tulane University for many suggestive criticisms.

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pass lightly over the fact that we can never decide from physical phenomena whether the space we have assumed to be at rest is not after all in a state of uniform translation. Thus these two groups have an entirely separate existence, side by side. Their quite heterogeneous character may have discouraged their combination; but precisely this combination into one group gives us food for thought. We shall try to illustrate these relations graphically. Let x, y, z be rectangular coordinates of space and let t represent time. As they occur in our experience places and times are always combined. No one has ever observed a place except at a time, nor a time except in a place. But here I am still respecting the dogma that space and time have each an independent significance. I shall call a point in space at a definite time, that is, a system of values, x, y, z, t, a "world-point (*Weltpunkt*). The multiplicity of all possible systems of values x, y, z, t I shall call the world. I might boldly sketch four world-axes on the blackboard. Even *one* such axis consists merely of vibrating molecules and travels with the earth in space, thus alone furnishing us with sufficient food for abstract thought; the somewhat greater abstraction involved in the number four does not disturb the mathematician. In order not to have an empty void anywhere we shall assume that there is something perceptible everywhere and at all times. To avoid the terms matter or electricity we shall call this something substance. Let us direct our attention to the substance-point (*substantiellen Punkt*) at the world-point x, y, z, t, and imagine that we are able to recognize this substance-point at every other time. Let the changes dx, dy, dz, of the space coordinates of this substance-point correspond to an element of time dt. We thus obtain as a representation so to speak of the eternal course of the substance-point a curve in the world, a world-line whose points can be determined uniquely in terms of a parameter t from $-\infty$ to $+\infty$. The whole world stands resolved into such world-lines, and I wish at once to make the fundamental assertion that according to my opinion physical laws may find their most complete expression as mutual relations among these world-lines.

By the concepts space and time, the x, y, z-manifold $t=0$ and its two sides $t>0$ and $t<0$ become separated. If for simplicity we keep the zero point of time and space fixed, then the first mentioned group of mechanics means that we can give any rotation around the origin to the x, y, z-axes in $t=0$ corresponding to the

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homogeneous linear transformations of the expression $x^2+y^2+z^2$ into itself.

But the second group or invariance means that without changing the expressions of the laws of mechanics, we can replace x, y, z, t by $x-at$, $y-\beta t$, $z-\gamma t$, t, a, β, γ being any constants whatever. The time-axis can accordingly be given any direction whatever toward the upper half-world $t>0$. Now what connection has the condition of orthogonality in space with this complete upward freedom of the time-axis?

To exhibit the connection we take a positive parameter c and consider the locus

$$c^2t^2-x^2-y^2-z^2=1.$$

It consists of two sheets separated by $t=0$ analogous to a hyperboloid of two sheets. Considering the sheet in the region $t>0$ we now conceive those homogeneous linear transformations of x, y, z, t into four new variables x', y', z', t', in which the expression for this sheet of the hyperboloid in the new variables corresponds to the original expression. Evidently the rotations of space about the origin belong to these transformations. We shall next obtain a full understanding of the remaining transformations by considering one in which y and z remain unchanged. Let us draw (Fig. 1) the intersection of this sheet with the plane of the x- and t-axes, the

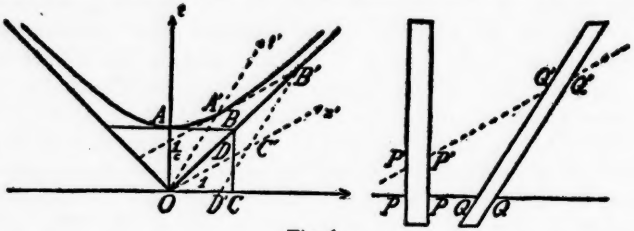

Fig. 1.

upper branch of the hyperbola $c^2t^2-x^2=1$ with its asymptotes. Then let any radius vector OA′ of this branch of the hyperbola be constructed from the origin O, let the tangent to the hyperbola at A′ be extended to the right until it intersects the asymptote at B′, let OA′B′ be completed to form the parallelogram OA′B′C′, and finally for later developments let B′C′ be continued to D′, its intersection with the *x-axis*. If we then take OC′ and OA′ as axes for parallel coordinates x' and t' with units OC′=1, OA′=1/c, then this branch of the hyperbola again has the equation $c^2t'^2-x'^2=1$, $t>0$, and the

transition from x, y, z, t to x', y, z, t' is of the type under consideration. We now add to these transformations all arbitrary shiftings of the space and time origin, and in this way construct a group of transformations obviously still dependent on the parameter c, which I designate by G_c.

If we now let c increase to infinity, $1/c$ thus converging to zero, we see from the figure described that the branch of the hyperbola always approaches closer to the x-axis and the angle between the asymptotes widens into a straight angle. At the limit the special transformation changes into one in which the t'-axis can have any upward direction and x' steadily approaches nearer to x. In consequence of this it is clear that the group G_c, in the limit for $c=\infty$, thus as the group G_∞, becomes the complete group of Newton's mechanics. Under these circumstances and since G_c is mathematically more intelligible than G_∞, a mathematician in the free play of his imagination might well have had the idea that, after all, the phenomena of nature do not actually remain invariant for the group G_∞, but rather for a group G_c with a c that is definite and finite but *very large* if taken in the ordinary units. Such an idea would have been an extraordinary triumph of pure mathematics. Now, although mathematics has here been caught napping she still has the satisfaction that, owing to her happy antecedents, through senses made keen by their exercise in broad vistas, she is capable of grasping at once the far-reaching consequences of such a transformation of our conception of nature.

I shall now indicate what value of c will finally come into consideration. For c we shall substitute the *velocity of light in a vacuum*. In order to avoid the terms "space" and "void" we can define this magnitude as the ratio between the electromagnetic and the electrostatic units of electric quantity.

The existence of the invariance of natural laws for the group G_c under consideration would now be expressed as follows:

From the totality of natural phenomena we can derive with ever increasing exactitude by successively closer and closer approximations, a system of reference x, y, z, and t, space and time, in terms of which these phenomena are then represented according to definite laws. But this system of reference is by no means uniquely determined thereby. *It is still possible to change this system of reference at will corresponding to the transformations of the above mentioned group* G_c, without changing thereby the expression of natural laws.

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For example, according to the described figure we can also call t the time, but then in connection with it we must necessarily define space by the manifold of the three parameters, x', y, z, in which case physical laws would be expressed in terms of x', y, z, t', exactly the same as in terms of x, y, z, t. According to this there would be in the world not that particular space but an infinite number of spaces, just as there is an infinite number of planes in three-dimensional space. Three-dimensional geometry becomes a chapter of four-dimensional physics. You now understand why I said at the outset that space and time are to fade away into mere shadows and that only a world-in-itself will exist.

II.

Now the question is, what circumstances force the changed conception of space and time on us? Does it never, as a matter of fact, contradict phenomena? And finally, has it advantages for the description of phenomena?

Before we enter into these questions, let us first make an important observation. When we individualize space and time in any manner, then a straight line parallel to the t-axis corresponds as world-line to a substance point at rest, a straight line inclined to the t-axis corresponds to a uniformly moving substance-point, and a world-line curved at will corresponds to a not-uniformly moving substance point. If we consider the world-line passing through any world-point x, y, z, t, and if we there find it parallel to any radius vector OA′ of the above-mentioned hyperboloid sheet, we may introduce OA′ as the new time-axis, and in the new conception of space and time thus obtained substance appears at rest at the world-point in question. Let us now introduce this fundamental axiom:

By a suitable determination of time and space, the substance present at any world-point whatever may always be conceived of as at rest.

This axiom means that in every world-point the expression

$$c^2\,dt^2 - dx^2 - dy^2 - dz^2$$

is always positive or, what amounts to the same thing, every velocity v is always less than c. According to this, c would exist as upper limit for all substance velocities and in this fact would lie the deeper significance of the magnitude c. In this other form the axiom has in it something which at first sight is unsatisfactory. But we must

consider that now a modified mechanics will supersede the old—one into which will enter the square root of the above combination of differentials of the second degree, so that cases involving velocities exceeding that of light will only play some such part as figures with imaginary coordinates play in geometry.

The *impulse* and actual motive *for the assumption of the group* G_c originated through the fact[2] that the differential equation for the transmission of light-waves in empty space is actually characterized by the Group G_c. On the other hand the concept of rigid bodies has a meaning only in a mechanics with the group G_∞. If we have an optics with G_c and if on the other hand rigid bodies existed, it is easy to perceive that by the two hyperboloid sheets belonging to G and to G_∞ a definite t direction would be determined, and this would have the further result that we must be able to detect by means of suitable rigid optical instruments in the laboratory, a change in the phenomena at different orientations with reference to the direction of the earth's motion. All attempts, however, at this detection, especially a famous interference experiment of Michelson, had a negative result. To find an explanation for this, H. A. Lorentz constructed a hypothesis the value of which depends on the invariance of optics for the group G_c. According to Lorentz, every body in motion suffers a contraction in the direction of the motion, and for the velocity v this contraction is in the ratio

$$1 : \sqrt{1 - (v^2/c^2)}.$$

This hypothesis sounds very fantastic, for the contraction is not to be regarded as a consequence of resistance in the ether but entirely as a gift from above, a phenomenon accompanying the state of motion.

I shall now show by our figure that the Lorentz hypothesis is entirely equivalent to the new conception of space and time through which it may much more readily be understood. If, for simplicity's sake we ignore y and z and consider a world of one space dimension, then parallel strips, an upright one like the t-axis, and one inclined to it (see Fig. 1) represent the path respectively of a stationary and a uniformly moving body which in both cases maintain a constant spatial extent. If OA′ is parallel to the second strip, we can introduce t' as time and x' as the space coordinate, and the

[2] What is practically an application of this fact is to be found as early as 1887 in a contribution by W. Voight in *Nachrichten der K. Gesellschaft der Wissenschaften zu Göttingen*, mathematisch-physikalische Klasse, page 41.

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second body then appears at rest and the first in uniform motion. We now assume that the first body conceived as at rest has the length l, that is, the cross-section PP of the first strip on the x-axis $= l.\mathrm{OC}$ where OC denotes the unit on the x-axis; and on the other hand that the second body *conceived as at rest* has the same length l, that is, the cross-section of the secondstrip, measured parallel to the x'-axis gives the equation $\mathrm{Q'Q'} = l.\mathrm{OC'}$. We now have in these two bodies constructions of two *equal* Lorentz electrons, one at rest and one in uniform motion. If we keep the original coordinates x, t, fixed, then the section QQ of the respective strip *parallel to the x-axis*, must be regarded as an extension of the second electron. Now it is clear since $\mathrm{Q'Q'} = l.\mathrm{OC'}$ that $\mathrm{QQ} = l.\mathrm{OD'}$. A simple calculation shows that if $(dx/dt) = v$ for the second strip,

$$\mathrm{OD'} = \mathrm{OC}\sqrt{1-(v^2/c^2)},$$

and therefore also $\mathrm{PP}:\mathrm{QQ} = 1:\sqrt{1-(v^2/c^2)}$. But this is the meaning of the hypothesis of Lorentz on the contraction of electrons in motion. If, on the other hand, adopting the system of reference x' t', we regard the second electron as at rest, then the length of the first will be denoted by the cross section P' P' of its strip parallel to OC', and we would find the first electron shortened in exactly the same proportion with reference to the second. For it is according to the figure:

$$\mathrm{P'P'}:\mathrm{Q'Q'} = \mathrm{OD}:\mathrm{OC'} = \mathrm{OD'}:\mathrm{OC} = \mathrm{QQ}:\mathrm{PP}.$$

Lorentz called the combination t' of x and t the *place-time* of the uniformly moving electron and used a physical construction of this conception for the better understanding of the contraction hypothesis. But it remained for A. Einstein[3] to recognize clearly that the time of one electron was just as good as that of the other, that is, that t and t' are to be treated alike. Thus time was the first to be discarded as a concept determined uniquely by phenomena.

Neither Einstein nor Lorentz disturbed the conception of space, perhaps for the reason that in the special transformation where the x', t' plane coincides with the x, t plane it is possible to interpret the x-axis of space as remaining fixed in its position. To loftily ignore the conception of space in similar wise is doubtless due to the boldness of mathematical discipline. After this further step which however is indispensable for a true understanding of the group G_c, the expression *postulate of relativity* for the demand for an invariance

[3] A. Einstein, *Annalen der Physik*, XVII, 1905, p. 891; *Jahrbuch der Radioaktivität und Electronik*, IV, 1907, p. 411.

in the group G_e, seems to me very weak. Since the postulate comes to mean that phenomena occur only in the four-dimensional world of space and time but the projection into space and into time can still be assumed with a certain degree of freedom, I would rather call this proposition the *postulate of the absolute world* (or for short, *world-postulate*).

III.

Through the world-postulate a similar kind of treatment of the four determining elements x, y, z, t, becomes possible. Through it, as I shall now show, we gain an insight into the forms under which physical laws operate. Above all, the conception of *acceleration* becomes sharply defined.

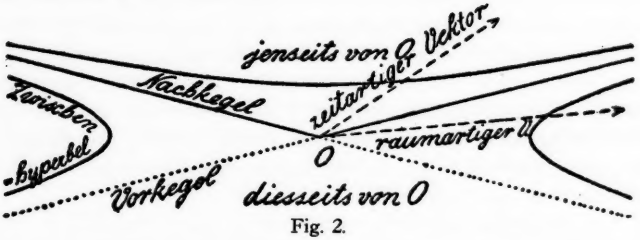

Fig. 2.

I shall use a geometrical mode of expression which at once suggests itself, at the same time tacitly ignoring z in the triplet x, y, z. I take any world-point, O, as the space-time origin. The *cone* $c^2t^2 - x^2 - y^2 - z^2 = 0$ with O as vertex (Fig. 2) consists of two parts, one with the values of $f < 0$, another with the values of $t > 0$. The first, the *"past" cone* (*Nachkegel*) *of* O consists, let us say, of all world-points which "send light to O"; the second, the *"future" cone* (*Vorkegel*) *of* O, consists of all points which "receive light from O." The region bounded only by the future cone of O may be designated *this side of* O (*diesseits von* O), and that bounded only by the past cone, *the other side of* O (*jenseits von* O). The hyperboloid sheet considered above,

$F = c^2t^2 - x^2 - y^2 - z^2 = 1$, $t > 0$, falls to the other side of O.

The region between the cones is filled with the hyperboloidic forms of one sheet

$$-F = x^2 + y^2 + z^2 - c^2t^2 = k^2$$

for all constant positive values of k^2. Of importance for us are the hyperbolas with O as center which lie on the latter loci. The

single branches may be called briefly *interhyperbolas* (*Zwischenhyperbeln*) *with center* O. Such a branch of a hyperbola, considered as the world-line of a substance-point, would represent a motion which, for $t=-\infty$ and $t=+\infty$ aproaches asymptotically the velocity of light, c.

If now in analogy to the concept of a vector in space, we call a directed tract (*gerichtete Strecke*) in the manifold x, y, z, t, a *vector*, then we must differentiate between time vectors (*zeitartigen Vektoren*) with a direction from O to the sheet $+F=1$, $t>0$, and the space-vectors (*raumartigen Vektoren*) with a direction from O to $-F=1$. The time-axis can be parallel to any vector of the first kind. Every world-point between the past cone and future cone of O can be arranged by the system of reference to be *simultaneous* with O, but equally well as *previous to* O or *later than* O. Every world-point on this side of O is necessarily always previous to O, every world-point on the other side of O necessarily always later than O. Passing the limit for $c=\infty$ would correspond to the complete closing up of the wedge-shaped section between the cones into the plane manifold $t=0$. In our figures this section has purposely been made of different widths.

Let us resolve any vector whatever as from O to x, y, z, t, into the four *components*, x, y, z, t. If the directions of two vectors are respectively those of a radius vector OR from O to one of the surfaces $\mp F=1$ and of a tangent RS at the point R of the surface concerned, then the vectors shall be called *normal* to each other. Accordingly

$$c^2 tt_1 - xx_1 - yy_1 - zz_1 = 0$$

is the condition that the vectors with the components x, y, z, t, and x_1, y_1, z_1, t_1 are normal to each other.

The *unit measures* for the scalars of vectors of different directions are to be so determined that the scalar 1 shall always be given to a space-vector from O to $-F=1$, and $1/c$ to a time-vector from

$$\text{O to } F=1,\ t>0.$$

If we now consider the world-line of a substance point passing through a world-point P (x, y, z, t), the scalar

$$d\tau = (1/c)\sqrt{c^2\,dt^2 - dx^2 - dy^2 - dz^2}$$

accordingly then corresponds to the differential time-vector dx, dy, dz, dt in passing along the line.

The integral $\int d\tau = \tau$ of this quantity on the world-line meas-

ured from any fixed initial point P_0 to a variable terminal point P, we call the characteristic time (*Eigenzeit*) of the substance-point at P. On the world-line we consider x, y, z, t (the components of the vector OP) as functions of the characteristic time τ and designate their first derivatives with respect to t by $\dot{x}, \dot{y}, \dot{z}, \dot{t}$, the second derivatives with respect to t by $\ddot{x}, \ddot{y}, \ddot{z}, \ddot{t}$, and call the vectors formed from these, the derivative of the vector OP with respect to τ the *velocity--vector at* P and the derivative of this velocity-vector with respect to τ the *acceleration-vector at* P. Then the relations hold:

$$c^2\dot{t}^2 - \dot{x}^2 - \dot{y}^2 - \dot{z}^2 = c^2$$
$$c^2\dot{t}\ddot{t} - \dot{x}\ddot{x} - \dot{y}\ddot{y} - \dot{z}\ddot{z} - 0,$$

that is, the velocity-vector is the time-vector in the direction of world-line at P of unit length and the acceleration-vector at P is normal to the velocity-vector of P, therefore certainly a space-vector.

Now there exists, as is easily seen, a definite hyperbola branch which has three consecutive points in common with the world-line (*Weltlinie*) at P and whose asymptotes are generators of a past and future cone (see Figure 3 below). Let this hyperbola branch be called the *hyperbola of curvature* (*Krümmungshperbel*) *at* P. If M is the center of this hyperbola we are here concerned with an interhyperbola with its center at M. Let ρ be the length of the vector MP, *then we find the acceleration-vector at* P *to be the vector in the direction* MP *of length* c^2/ρ.

If $\ddot{x}, \ddot{y}, \ddot{z}, \ddot{t}$, are all zero, then the hyperbola of curvature reduces to the straight line touching the world-line at P, and ρ is to be put equal to ∞.

IV.

To show that the assumption of the group G_c as holding in the laws of physics does not lead to a contradiction, it is indispensable to undertake a revision of the whole of physics on the basis of this assumption. This revision has already been successfully carried out within a certain region for questions of thermo-dynamics and radiation of heat,[4] for electromagnetic processes and finally for mechanics with retention of the concept of mass.[5]

[4] M. Planck, "Zur Dynamik bewegter Systeme," *Sitzungsberichte der k. preussischen Akademie der Wissenschaften zu Berlin*, 1907, p. 542; also *Annalen der Physik*, Vol. XXVI, 1908, p. 1.

[5] H. Minkowski, "Die Grundgleichungen für die elektromagnetischen Vorgänge in bewegten Körpern," *Nachrichten der k. Gesellschaft der Wissenschaften*

In the last-named field the first question that arises is: If a force with components X, Y, Z, along the space-axes is applied at a world-point P (x, y, z, t) where the velocity-vector is $\dot{x}, \dot{y}, \dot{z}, \dot{t}$, as what force is this to be conceived under any possible change of the system of reference? Now there exist tested lemmas about ponderomotive force in the electromagnetic field in the cases where the group G_c is certainly to be allowed. These lemmas lead to the simple rule: *On changing the system of reference the said force is to be applied in the new space coordinates, so that the vector pertaining thereto with the components.*

$$iX,\ iY,\ iZ,\ iT$$

where $$T = 1/c^2\ (\dot{x}/i\dot{t}X + \dot{y}/i\dot{t}Y + \dot{z}/i\dot{t}Z)$$

is the work that the force divided by c^2 performs at the world-point, all remain unchanged. This vector is always normal to the velocity-vector at P. Such a vector belonging to a force at P shall be called a *moving force-vector at* P.

Now let the world-line running through P be described by a substance-point with a constant *mechanical mass m.* Let m times the velocity-vector at P be called the *impulse-vector at* P, and the m times the acceleration-vector at P be called the *force-vector of the motion at* P. According to these definitions the law describing the motion of a mass point with a given moving force-vector reads:[6] *The force-vector of the motion is equal to the moving force-vector.*

This statement summarizes four equations for the components along the four axes, of which the fourth (because both of the described vectors were *a priori* normal to the velocity-vector) can be regarded as a consequence of the first three. According to the above meaning of T the fourth equation undoubtedly expresses the law of energy. The *kinetic energy* of point-mass is therefore to be defined as *c^2 times the component of the impulse-vector along the t-axis.* The expression for this is

$$mc^2(dt/d\tau) = mc^2/\sqrt{1-(v^2/c^2}},$$

which, after subtracting the additive constant mc^2 and neglecting quantities of the order $1/c^2$ is the expression of kinetic energy in

zu Göttingen (mathematisch-physikalische Klasse) 1908, p. 53, and *Mathematische Annalen,* Vol. LXVIII, 1910, p. 527; H. Minkowski, *Gesammelte Abhandlungen,* Vol. II, p. 352.

[6] H. Minkowski, *Gesammelte Abhandlungen,* Vol. II, p. 400. Compare also M. Planck, *Verhandlungen der Physikalischen Gesellschaft,* Vol. IV, 1906, p. 136.

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Newtonian mechanics $\frac{1}{2}mv^2$. In this the dependence of energy on the system of reference appears obvious. But since the t-axis can now be taken in the direction of any time-vector, the law of energy, on the other hand, formulated for every possible system of reference, contains the entire system of equations of motion. This fact retains its significance in the above-mentioned limiting case for $c=\infty$, also for the deductive development of the Newtonian mechanics, and in this sense it has already been noted by J. R. Schütz.[7]

We can from the start so determine the relation of unit length to unit time, that the natural limit of velocity becomes $c=1$. If we then introduce $\sqrt{-1}.t$ s in place of t the quadratic differential expression becomes

$$dr^2 = -dx^2 - dy^2 - dz^2 - ds^2$$

thus completely symmetrical in x, y, z, s, and this symmetry now enters into every law which does not contradict the world-postulate. Accordingly we can express the essence of this postulate very significantly in the mystical formula:

300,000 kilometers $\sqrt{-1}$ second.

v.

Perhaps the advantages secured by the world-postulate are nowhere show more impressively than in stating the effect according to the Maxwell-Lorentz theory of a point-charge moving at will. Let us consider the world-line of such a paint-electron with the charge e and introduce the characteristic time τ from any initial point. To obtain the field determined by the electron at any world-point P_1 we construct the past cone P_1 (Fig. 4). This meets the infinite world-line of the electron at a single point P because its directions are everywhere those of a time vector. We construct the tangent at P to the world-line and through P_1 the normal P_1Q to this tangent. Let the scalar of P_1Q be r. Then, according to the definition of a past cone we must take the scalar value of PQ as r/c.

Now the vector in the direction PQ of length e/r represents in its components along the x-, y-, z-axes the vector potential multiplied by c, and in the component along the t-axis the scalar potential

[7] J. R. Schütz, "Das Prinzip der absoluten Erhaltung der Energie" in *Nachrichten der k. Gesellschaft der Wissenschaften zu Göttingen* (mathematisch-physikalische Klasse), 1897, p. 110.

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of the field produced by e for the world-point P_1. This is the basis of the fundamental laws established by A. Liénard and E. Wiechert.[8]

In the description of the field itself produced by the electron it is clearly seen that the separation of the field into electric and magnetic forces is a relative one depending on the time axis of reference. Both forces can be described together most luminously after the analogy, however imperfect, of a force screw in mechanics.

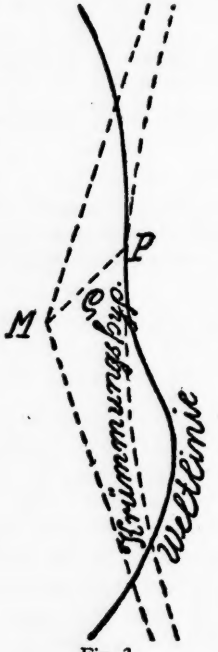

Fig. 3.

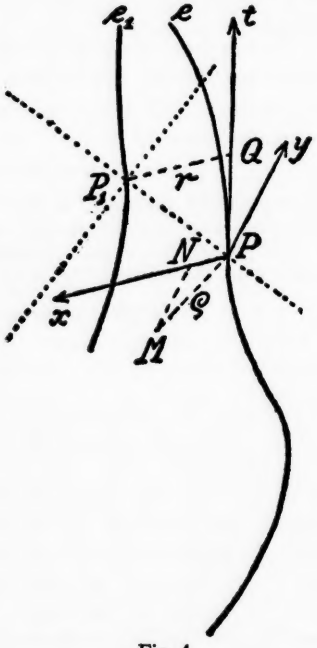

Fig. 4.

I shall now describe the *ponderomotive effect of one point-charge moving at will on another point-charge moving at will.* Let us take the world-line of the second point-electron of charge e_1, passing through the world-point P_1. Let us determine P, Q, r as before, then (Fig. 4) construct the center M of the hyperbola of

[8] A. Liénard, "Champ électrique et magnétique produit par une charge concentrée en un point et animée d'un mouvement quelconque," in *L'éclairage électrique*, Vol. XVI, 1898, pp. 5, 53, 106; E. Wiechert, "Elektrodynamische Elementargesetze" in *Archives néerlandaises des sciences exactes et naturelles* (2), Vol. V, 1900, p. 549.

curvature at P, and finally the normal MN from M to a straight line through P parallel to QP_1. Let us next determine with P as origin a system of reference with the t-axis in the direction of PQ, the x-axis in the direction of QP_1, the y-axis in the direction of MN, so that finally the direction of the z-axis is determined as normal to the t-, x-, y-axes. Let the acceleration vector at P be $\ddot{x}, \ddot{y}, \ddot{z}, \ddot{t}$, and the velocity-vector at P_1 be $\dot{x}_1, \dot{y}_1, \dot{z}_1, \dot{t}_1$. Now the action of the moving force-vector of the first electron e moving at will on the second electron e_1 moving at will at P_1 is formulated thus:

$$-ee_1(\dot{t}_1-\dot{x}_1/c)\mathfrak{K},$$

in which the three relations between the components $\mathfrak{K}x, \mathfrak{K}y, \mathfrak{K}z, \mathfrak{K}t$, of the vector $\mathfrak{K}$ are: $c\mathfrak{K}t - \mathfrak{K}x = 1/r^2$, $\mathfrak{K}y = \ddot{y}/c^2r$, $\mathfrak{K}z = 0$ and lastly, this vector $\mathfrak{K}$ is normal to the velocity-vector at P_1 and through this circumstance alone is dependent on the latter velocity-vector.

If we compare this statement with the previous formulation[9] of the same fundamental law of the ponderomotive effect of moving point-charges on each other, we cannot but grant that the relations here coming under observation do not manifest their intrinsic character of utter simplicity except in four dimensions, but throw a very complicated projection upon a tri-dimensional space preimposed upon them.

In mechanics reformed according to the world-postulate the disagreements which have caused friction between the Newtonian mechanics and modern electrodynamics disappear of their own accord. I shall touch upon the relation of the *Newtonian law of attraction* to this postulate. I shall assume that when two point masses m and m_1 describe their world-lines a moving force-vector acts from m on m_1 just as in the above expression in the case of electrons, except that now mm_1 is to be substituted for $-ee_1$.

We shall now consider especially the particular case where the acceleration-vector of m is constantly zero, in which case we can so introduce t that m is conceived of as at rest, and the motion of m_1 depends only on the moving force-vector proceeding from m. If we modify this vector first by the factor

$$t^{-1} = \sqrt{1-v^2/c^2},$$

[9] K.Schwarzschild, *Nachrichten der k. Gesellschaft der Wissenschaften zu Göttingen* (mathematisch-physikalische Klasse), 1903. p. 132. H. A. Lorentz, *Enzyklopädie der mathematischen Wissenschaften*, Vol. V, Art. 14, p. 199.

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which, up to quantities of the order $1/c^2$ is equal to 1, then it follows[10] that for positions x_1, y_1, z_1 of m_1 and their corresponding time-positions, Kepler's laws would again obtain, except that in place of the times t_1 the characteristic time τ_1 of m would be substituted.

On the basis of this simple observation we can see that the proposed law of attraction in conjunction with the new mechanics would be no less suitable for explaining astronomical observations than Newton's law of attraction in conjunction with the Newtonian mechanics.

The fundamental equations for electromagnetic processes in ponderable bodies are likewise in complete harmony with the world-postulate. Even the derivation of these equations, as taught by Lorentz, on the basis of conceptions of the electron theory need not for this end by any means be abandoned, as I shall show elsewhere.[11]

The universal validity of the world-postulate is, I should believe, the true core of an electromagnetic world-picture; first discovered by Lorentz, then further developed by Einstein, it is now clearly discernible. In the future development of its mathematical consequences enough indications will be found for experimental verification of the postulate to reconcile by the idea of a pre-established harmony between pure mathematics and physics even those to whom a surrender of old accustomed view-points is uncongenial or painful.

HERMANN MINKOWSKI.

SUGGESTIONS FOR A NEW LOGIC.

The world of logic is in a state of disturbance. A new logic is wanted and anxiously sought after. The logisticians are active and non-Aristotelian thinkers are presenting solutions. Among those dissatisfied with both the traditional and modern logic there is one man of particular originality and distinction. It is Dr. Charles Mercier of Charing Cross Hospital, London, and we take pleasure in presenting a review of his work.

DR. MERCIER'S LOGICAL WORK.

Dr. Charles A. Mercier is a physician whose specialty is mental

[10] H. Minkowski, *Ges. Abhandlungen*, II, p. 403.

[11] This idea is developed in the paper: "Eine Ableitung der Grundgleichungen für die elektromagnetischen Vorgänge in bewegten Körpern vom Standpunkte der Elektronentheorie. Aus dem Nachlass von Hermann Minkowski bearbeitet von Max Born in Göttingen. *Mathematische Annalen*, Vol. LXVIII, 1910, p. 526; *Ges. Abhandlungen*, Vol. II, p. 405.

pathology. Believing that in mental as in bodily disorder the study of order is indispensable to the study of disorder, and that in mental disease the power of logical reasoning is often impaired, he thinks the knowledge of an adequate and correct logic very important and necessary. For this purpose he has found the traditional logic defective in every particular. Nor does he agree with Mill and the modern logicians who follow him, although they too found fault with the traditional school. He has frankly confessed that he does not understand their logic, and the symbolic logic of the logicians is even less satisfactory to him for this he considers no logic at all but "mathematics gone mad." Therefore he has written *A New Logic* of his own in a volume of 422 pages[1] which, though not complete and of course not wholly new, yet is different enough from all previous expositions to warrant the name. He regards his system as an organized and coherent body of doctrine, covering the whole field of reasoning, growing naturally from a single root and forming a harmonious and interdependent whole. And he hopes it will prove of great practical value in clarifying the ideas of the thoughtful and intelligent public with regard to the laws of reasoning. It is impossible to give any comprehensive summary of his method here, for he takes up the defects of the time-honored system one by one, and then in each case works out his own corresponding theory. But we can include here his sweeping indictment of traditional logic, which will give some idea of the scope of his contemplated reform. He says: "In my opinion, its concepts of the composition of the proposition, and of the constituent parts of the proposition, are erroneous; its doctrines of quantity and quality are wrong; its immediate inferences are but a poor few out of multitudes that may be obtained by an adequate logic; the few immediate inferences it does obtain are faulty; its doctrine of the syllogism is artificial and mistaken; the rules of the syllogism are all wrong; there are multitudes of mediate inferences that cannot be reached by the syllogism;....in short, its whole system is insufficient, defective, and erroneous from beginning to end."

Dr. Mercier takes issue with Mill and subsequent writers when they devote a chapter of their logic to the subject of causation and insist that causation lies at the root of induction, for he believes that causation no more belongs to the subject matter of logic than rotation or imitation; that it is neither a principle nor method, but

[1] London: Longmans Green and Co.; Chicago: Open Court Publishing Company, 1912.

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rather an example or application of reasoning. It is for this reason that his own treatment of causation is not included in *A New Logic* but is given in a volume by itself.[2] Dr. Mercier writes a direct and trenchant style. He is not only a critic of logic but proves to be a keenly logical critic, and his fearlessness of spirit and acuteness of mind are shown most delightfully in the first chapter of *Causation* which is devoted to the theories of Hume, Mill, Mr. Welton, Professor Pearson, Mr. Bertrand Russell and Dr. McTaggart. We will quote some of his more scathing and fun-provoking passages on the three last named, though for the full line of the author's critical arguments we must refer our readers to the book itself. On pages 18 to 31 he says:

"Much of the authority that Prof. Pearson's *Grammar of Science* has unquestionably achieved is due to his habit of attributing his own opinions to a personified science, a trick that enables him to pose as infallible, while adroitly avoiding the appearance of arrogance that such a pose carries with it. When he says that for science cause is meaningless, he means that Professor Pearson does not understand the meaning of it; when he says that science can in no case demonstrate this or that, he means that Professor Pearson cannot demonstrate it; when he says that science can find no element of enforcement in causation, he means that Professor Pearson is too blind to see the element of enforcement; and so on. This is an adroit method of imposing on the gullibility of his readers, for who, in these 'scientific' days, would have the temerity to question the pronouncements of science? But I must confess to some surprise that it has been so successful. I should have thought that it might have occurred to some one that science in this sense is only a name for a body of opinion; a body of fluctuating opinion, varying from time to time and from person to person, so that what is science to-day was heresy yesterday, and will be superstition to-morrow; what is science to one is stupidity to another, and falsehood to a third. What is science to Professor Pearson, for instance, is nonsense to me.

"Professor Pearson belongs to the school of Hume and Mill, and with them denies that there is any 'enforcement' of an effect by its cause, or any necessary connection between them. The cause is merely the antecedent, the effect merely the subsequent. The one happens to follow the other, but there is no reason or necessity why

[2] *On Causation with a Chapter on Belief.* London and New York: Longmans, Green and Co., 1916.

it should be so: they are in no way connected; but when we see repeated instances of the same succession of events, we deludedly jump to the conclusion that the predecessor is the cause of the successor. Almost as soon as it was stated, Reid blew this doctrine sky high by adducing the instance of night and day. Day always precedes night, and night always follows day, but no one supposes that day is the cause of night or that night is the effect of day. And why not? Manifestly because they are merely antecedent and subsequent; because there is no power in day to produce night; because there is no enforcement of night by day....By cause we do not mean mere antecedence, nor by effect do we mean mere succession. If we did, we should accept day as the cause of night, and night as the effect of day. If we did, the old and notorious fallacy, *post hoc, ergo propter hoc,* would be no fallacy: it would be an unassailable truth; yet the same logicians who declare in their chapters on occasion and induction that causation is nothing but sequence, declare in their chapter on fallacies that it is fallacious to argue from *post hoc* to *propter hoc.* But no inconsistency or self-contradiction in a doctrine ever yet deterred logicians from teaching it; and no doubt they will continue to teach this self-contradiction along with the rest, until the whole silly pseudo-science is swept away, and goes to join judicial astrology, phrenology, and humoral pathology upon the rubbish heap.

"Professor Pearson goes with the crowd, and quotes as from Mill the definition that causation is uniform antecedence; and this definition, says Professor Pearson, is perfectly in accord with scientific concept—that is, with Professor Pearson's concept. It may be a good definition, but when Professor Pearson says it is John Stuart Mill's definition, he is mistaken. Among all of Mill's many definitions of cause and causation this one is not to be found. In this instance 'science' is at fault....

"The most popular doctrine of Professor Pearson's is his distinction between *how* and *why*, a distinction which is either the cause, or the chief effect, of his theory of causation. He denies that we can ever discover *why* a thing happens, or explain it; and limits our powers to saying *how* it happens, or describing it. In this he is demonstrably wrong. It is often as impossible to describe how things happen as to explain why they happen: it is often as easy to explain why they happen as to describe how they happen. The fact is that both *how* and *why* are equivocal words, having

more than one meaning; but whichever meaning we take, what I have said is true....

"A good example of the manner in which Professor Pearson poses as a superior being is the advice he gives to his readers, to analyze what is meant by such statements as that the law of gravitation *causes* bodies to fall to the earth. The law, he says, really describes how bodies do fall. Of course it does; but before Professor Pearson gave this advice to his readers, he should have shown some evidence that some one besides himself had ever said such a silly thing. As far as I know, no one has ever pretended that the *law* of gravitation causes bodies to fall to the earth; but if any one should say the *fact* of gravitation—the fact that they attract each other—causes bodies to fall to the earth, he would say what is exactly and punctually true. The law of gravitation describes *how* bodies fall: the fact of gravitation explains *why* they fall; and the explanation is as good and as valid as the description. As far as I know, Professor Pearson never answers the actual arguments of real antagonists; and if he prefers the easier task of answering silly arguments that he puts into the mouth of an imaginary antagonist, then, whatever we may think of his courage and sincerity, we cannot question his wisdom.

"Mr. Bertrand Russell follows Professor Pearson in denying the existence of causes. He say there are no such things. He wants the word abolished, and regards the law of causation, or, as he calls it, of causality, as a relic of a bygone age. To prove this contention he selects from Baldwin's *dictionary* the definitions given therein of Causality, of the notion of Cause and Effect, and so forth; he takes one of Mill's definitions of Causation, and an expression of Bergson's, and analyzes them all destructively.

"All these expressions assume, and Mr. Russell repeatedly in his own expressions assumes, that repetition of instances is necessary before we can identify causation, and I think it is not too much to say that he regards recurrence or repetition as a necessary element, either in causation itself, or in our idea of causation.... He confutes the succession in time of cause and effect, or that antecedence and consequence on which Mill and his school lay so much stress: 'No two instants are contiguous, since the time series is compact.' I cannot see that the conclusion follows from the premise. It seems to me that the more compact the time series, the more closely contiguous must be its instants. If Mr. Russell means that time is continuous, and not

made up of instants separated from one another by intervals that are not time, or in which there is no time, I should agree with him; but it is only in such an interrupted time series that the instants would not be contiguous. An instant, like an hour or a day, is a portion of time arbitrarily divided by an imaginary limit from that which precedes and that which follows, with both of which it is continuous or contiguous. But if Mr. Russell is right, and no two instants are contiguous, and if serial contiguity in time between cause and effect is necessary to causation, then this settles the question: then causation is impossible, and Mr. Russell's further argument is redundant, supererogatory, and unnecessary. But he does not think so.....

"He goes on to show that if cause and effect are not contiguous in time, then there must be an interval between them; and 'since there are no infinitesimal time intervals' this lapse of time must be finite. But if there is a finite interval of time between cause and effect, something may happen in that interval to prevent the effect following the cause. It is all very pretty word spinning, and for all I know it may apply to the kind of 'causality' that occurs in the moon, or in a universe of one dimension, but it has no relation whatever to causation as it is known on this earth. Mr. Russell assumes that effect follows cause in the sense of what carpenters call a butt joint, in the sense that the effect does not begin until the cause has ceased to act. That may be what happens in some other universe, but it is not what happens here. What happens here is quite different, as Mr. Russell might have known if he had considered an actual case of causation instead of speculating with $e_1, e_2, \ldots e_n$, and $t_1, t_2, \ldots t_n$, and τ. When, for instance, a man pushes a trolley, he causes it to move. The pushing is the cause, the movement is the effect. But the effect is not postponed until the cause has ceased to act. The effect does not come into existence at an instant contiguous to the cessation of the cause. The effect begins as soon, or almost as soon, as the cause begins; thereafter, cause and effect, the pushing and the movement, accompany one another, and proceed contemporaneously for a certain time; and at length, when the cause ceases, the effect ceases. Cause is contiguous to effect in this case, not end to end, but side by side for the greater portion of their duration. The joint is not a butt joint but a fish joint; and all Mr. Bertrand Russell's pretty word spinning goes for nothing.

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"His own statement of 'causality' cannot, he says, be put accurately in non-mathematical language; the nearest approach would be as follows: 'There is a constant relation between the state of the universe at any instant, and the rate of change at which any part of the universe is changing at that instant, such that the rate of change in the rate of change is determinate when the state of the universe is given.' It is with diffidence that I comment on this mysterious formula, but it seems to me clear that if anything can be discovered by its means, it is not the cause of a change, but the rate at which a change takes place, or rather the rate of change in a rate of change; which may be a desirable thing to know, but by no perversity of ingenuity can be twisted or tortured into a cause. But suppose the impossible to be true, and suppose that no cause of any thing can be discovered or assigned unless and until the state of the whole universe is known; then it is clear that no cause of anything ever has been discovered or ever can be discovered, for we can never know the state of the whole universe. But in fact many causes of many things are known, and more are being discovered every day. I know, for instance, that pushing a trolley is a cause of the movement of that trolley. I know that reading such disquisitions as Mr. Welton's, Professor Pearson's, and Mr. Bertrand Russell's, are among the causes of the estimate I have formed of philosophers. Mr. Bertrand Russell may be a great mathematician, Professor Pearson a great statistician, and Mr. Welton a great authority on education; but there is a certain proverb about the cobbler and his last that I would commend to the notice of all three. It may be that I must determine the state of this earth, and of everything upon it, in it, and around it; of all its continents, seas, rivers, lakes, and islands; of all its minerals, from the coal to the diamond; of all its vegetables, from the bacillus to the oak and the orchid; of all its animals, from the spirochæte to the whale; of all its human inhabitants, from the Bushman to Mr. Russell himself; and beyond this, of all the solar system, with its planets, planetary streams, satellites, and comets; of all the stars which we call fixed, with their temperatures, positions, sizes, movements, and chemical composition—it may be that I must know all these things with accuracy before I can discover what it is that is tickling my nose; but for my own part I don't believe it. In fact, I do not know all these things, I know only some of them, and I have already discovered the cause. No doubt

Mr. Bertrand Russell knows best, but my own private belief is that though mathematics cannot err, mathematicians can....

"For thorough mystification, and for the most extreme departure from plain meaning and common sense, Dr. McTaggart runs Mr. Bertrand Russell very hard. According to Dr. McTaggart, 'causation is a relation of implication between existent realities—or to put it more precisely, between existent substances.' This does not on the face of it afford us much help in understanding what causation is, but unlike most philosophers, Dr. McTaggart defines his terms, and for this one cannot be sufficiently grateful to him, not only on general grounds, but also for the surprising meanings that he shows lurk unsuspected in the most ordinary terms. A substance, for instance, according to Dr. McTaggart, is anything that can have qualities and relations; so that, for instance, the battle of Waterloo and a flash of lightning are substances in the McTaggartian sense. This is a bit startling, but definitions are so rare in philosophy that we must be thankful for any we can get, even if they leave us more mystified than before. The battle of Waterloo is presumably not only a substance but also an existing substance in the McTaggartian world, though to the rest of us it ceased to exist a hundred years ago. Causation, then, is a relation of implication between such existing substances as the battle of Waterloo and a flash of lightning; but what is a relation of implication? Here again Dr. McTaggart comes to the rescue with a definition. A relation of implication is a relation between two propositions, P and Q, such that P implies Q, when, if I know P to be true, I am justified by that alone in asserting that Q is true, and if I know Q to be false, I am justified by that alone in asserting P to be false.

"So far, so good, but still we are a long way from attaining a clear idea of causation; but Dr. McTaggart is not done yet. 'Strictly speaking,' he says, 'implication is a relation between propositions or truths [is a proposition, then, necessarily true?] and not between events . But it is convenient to extend our use of it, so as to say that if one proposition implies another, then the event asserted in the first implies the event asserted in the second [but how if neither of them asserts an event?]. It is in this sense that the cause implies the effect'—causes it, in fact. The jump from propositions to events is a bit startling to those who are not accustomed to the proper meaning of realities and substances, but interpreting these expressions to the best of my ability, I gather that when we say

the cause implies the effect, we mean that if the cause is true the effect is true, and if the effect is false the cause is false. But what on earth is the meaning of a cause or an effect being true or false? It does not appear that by a true cause Dr. McTaggart means the *causa vera* of the Schools, but what he does mean I cannot conjecture; and supposing this difficulty to be cleared up, what is the meaning of a false effect? Is it an effect that never happens? or is it an effect that is wrongly attributed to a certain cause? or is it something else? It is to be regretted that Dr. McTaggart has not supplemented his definitions with others, explaining the meaning of these terms. In this difficulty the only practicable expedient is to clothe the expression in circumstances—to apply the general rule to an individual case.

"I take, therefore, two propositions, 'Brutus killed Cæsar,' and 'Brutus and Cæsar were contemporaries,' which stand in relation of implication; for if P, or Brutus killed Cæsar, is true, then we are justified by that alone in asserting the truth of Q, that they were contemporaries; and if Q, or Brutus and Cæsar were contemporaries, is false, then we are justified by that alone in asserting the falsity of P, that Brutus killed Cæsar. This specimen fulfils all Dr. McTaggart's conditions. The relation is undoubtedly a relation of implication; and the killing of Cæsar by Brutus is a substance, for it can have qualities, such as treachery, unexpectedness, rapidity, and so forth. It does not seem to me to be an existing substance, it is true, but it is as much an existing substance as the battle of Waterloo. The contemporaneousness of Brutus and Cæsar is a relation, and therefore this also is a substance, and to the same extent the other is an existing substance. All the conditions being satisfied, we may therefore predicate a relation of causation between these two existing substances; but now our difficulties begin, for I cannot understand whether the fact that Brutus killed Cæsar caused them to live at the same time, or whether the fact that they were contemporaries caused Brutus to kill Cæsar, If the latter, why did not all his other contemporaries kill Cæsar? and why did not Cæsar kill Brutus? If the former, what caused Brutus and Cæsar to have so many other contemporaries? I have puzzled over these problems till my brain is almost turned, and I am no nearer a solution, and am obliged to give them up. I doubt whether any one but Dr. McTaggart could solve them; and a method which is useless in

the hands of every one but its inventor is never likely to become popular.

"Dr. McTaggart arrives at certain other conclusions that are interesting. He decides that there is no reason to believe 'that a cause exerts an activity or an effect.' What is meant by a cause exerting an effect I do not know, and another definition would be useful here; but if Dr. McTaggart means that a cause does not produce an effect, then I respectfully submit that it is not a cause. Moreover, if a cause does not exert an activity, it is only because it *is* an activity, or more properly an action. Cause and activity can no more be divorced than heat and motion, or solidity and resistance. Dr. McTaggart decides that cause and effect are not identical, a discovery that will not, I think, astonish any one but Mr. Welton; that the effect is not necessarily subsequent to the cause, and, indeed, he is not quite sure that the effect may not sometimes come first, and the cause follow after it; and at last he declares, in despair it seems to me, that though cause and effect are not identical, yet there is no means of knowing which is which, or at any rate, there is no clear distinction between them; and therefore, though we may speak of causal relations as existing between two terms, yet we ought not to speak of one of those terms as cause, and of the other as effect. I think we may legitimately complain that Dr. Taggart does not tell us what we ought to call them. Ought we to call them both X, or the one X and the other Y? Ought we to call the one beef, and the other Yorkshire pudding? Or ought we to call the one petticoat and the other trousers? Dr. McTaggart gives us no guidance, and the reader must choose for himself.

"The lecture in which Dr. McTaggart expounded these views was delivered at Newnham College, presumably to an audience of young women, and I trust he developed to them his views of the impropriety of naming the related terms when describing relations. He convinced them, I trust, that it is convenient to speak of the relation of marriage, but inconvenient (and perhaps improper), to speak of bride and bridegroom, or of husband and wife; that it is convenient to speak of parentage, but not of parents or of children; that it is convenient to speak of the relation of cousinhood, but that they should never allow themselves to use such expressions as Harry or Mary."

The second chapter defines effect, reason, result, cause, and the third is devoted to condition. The fourth deals with causation itself

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and works up to the author's definition of the term (page 75) as "the necessary connection between an action and the sequent change or accompanying unchange in the thing acted on." Then follows a chapter on "Subsidiary Problems," the last of which is the uniformity of nature. In his first chapter Dr. Mercier had quaintly observed that "no two philosophers agree on what is to be meant by the uniformity of nature; the only thing on which they agree, and when they do agree their unanimity is wonderful, is that nature is not uniform." Chapters six and seven treat various methods of ascertaining causes, and errors in attributing causation and finally one chapter is given to the practical subject of causes of death and insanity. It is an attempt to guide the physician in determining the primary and secondary causes of death as required in England by the Registrar General, and to avoid the confusion of a certain complex "table of causes" of insanity issued by the British Board of Control.

The chapter on belief was added as an afterthought at the request of a friend who was puzzled as to what to believe and disbelieve. In this the author makes no claim to philosophical profundity, but endeavors to furnish a basis by which the ordinary thoughtful man may avoid believing things that are irrational, baseless, absurd or self-contradictory. We quote the author's summary of this chapter (pages 227-228):

"The different meanings of 'believe' are defined, and the meanings of various cognate expressions explained. An assertion of any degree of belief or disbelief expresses an attitude of mind either directly toward a fact, or, while directly toward a statement, indirectly toward the fact stated.

"A fact means anything existing or happening, in the past, present, or future.

"Belief ought to conform to fact, but cannot be directly related to fact, for we have no direct knowledge of fact. Between belief and fact there is always the intermediary of evidence. It is evidence and not fact that impresses our minds, and when we have brought our belief, or the want of it, into accordance with the evidence, we have done all we can, and can do no more.

"Evidence is of three kinds: Evidence of sense, evidence of reason, evidence of hearsay.

"Evidence of sense is certain as to the sensation only; but sensation is of little value until it is interpreted, that is, until its source

or cause is arrived at by the elementary process of reasoning called perception. This process may be faulty, and the percept false, or erroneous.

"Evidence of reason gives us two criteria of certainty. That which cannot be conceived is certainly false, and its contradictory is certainly true, and constitutes an axiomatic truth or certainty. It is necessary, in using this test, to be careful not to confuse, as Mill and Spencer did, inconceivability with incredibility.

"Empirical certainty rests upon constancy in experience. That relation which has been found constant (i. e., never contradicted) in experiences diverse and incalculably numerous, is true for us, and cannot be believed to be false, although its contradictory may be conceivable.

"If the relation is not constant in experience, then the degree of belief ought to correspond with the proportion that the positive instances in experience of the relation bear to the negative instances, in which the terms of the relation occur apart. The more nearly constant in experience the relation, the more carefully should apparent exceptions be scrutinized.

"Evidence of hearsay may be maximally trustworthy or may be worthless. The following are the criteria to be depended on:

"1. The statement must be understood in the same sense by the receiver as by the assertor.

"2. The witness must be a witness of truth so far as he knows the truth.

"3. The witness must have means of knowing the truth.

"4. The hearsay evidence must not be inconsistent, or even incongruous with experience.

"Whoso makes an assertion, on him lies the burden of proof. No attention should be paid to bare assertion unsupported by evidence.

"Evidence is anything germane to the issue, and consistent with the assertion.

"Proof is evidence inconsistent with any alternative to the assertion.

"Disproof is evidence inconsistent with the assertion.

"The evidence of a single witness may be received in proportion to his previous record for truthfulness, and in proportion to his responsibility, that is to say to the ill-consequences that

would accrue to him if he were found to have given false testimony; also to his freedom from interest and bias in making his assertion.

"The evidence of a plurality of witnesses is valuable in proportion to their independence of one another. Evidence of many independent witnesses goes to prove an assertion if they have means of knowing the truth, and if the assertion is consistent with experience. Otherwise, the evidence of witnesses, however many and however unanimous, has no value."

Though we hesitate to draw inferences with regard to an author who has such a ready eye for fallacies, it seems to us that the logical consequent of this chapter ought to be an essay on New Testament criticism or at least on that phase which deals with the doctrine of the resurrection of Jesus.

EDITOR.

LAWRENCE HEYWORTH MILLS.

1837-1918.

On February first despatches from London announced to American newspapers the death of one of those great Oriental scholars whose researches in difficult fields have been the glory of the nineteenth century. Lawrence Heyworth Mills, professor of Zend philology at Oxford since 1898, died at the ripe age of eighty-one years. In him science and literature lose another great figure, one of those who faithfully and courageously pursued the missionary labor of revealing the religious lore of the great, dead civilizations of the East to a West, which in its selfsufficiency always reacted but slowly and unwillingly to messages deemed by its utilitarian spirit to be of little, or at least, of questionable worth.

Though Professor Mills left for a permanent residence in Europe in 1872, he was of American birth, and we select from Dr. Carus's warm tribute to an esteemed contributor to *Open Court* and *Monist*, as found on pages 505 to 509 of volume XIII, the following salient facts.

He was born in New York in 1837 of German and Irish ancestry, long resident in colonial America. Educated for the ministry and ordained, he was active in ecclesiastical duties from 1861 to 1872 in our country and then in the Protestant Episcopal church

of the American colony in Florence, Italy, where he resided until 1877 while continuing the prosecution of those studies on gnosticism that had been begun in America. Removing to Germany in that year on the advice of his physician, he began the publication of his first and tentative edition of the Gāthas with four texts, of which three were translated, between 1879 and 1881. Thus favorably introduced to scholars, he was in 1883 urged by the great Orientalists Max Müller and James Darmesteter, and strongly encouraged to undertake the edition of what was probably the most difficult book of the *Sacred Books of the East,* the XXXIst, including as it did, the translation of the Gāthas. This was his most distinguished service to science, and it brought him to England in 1886 in pursuance of a request of Max Müller to see the work through the press. Henceforth his destinies centered about the great English university, Oxford, for the library of which he was largely instrumental in procuring in 1888 what has been called one of the "most precious gifts ever given it," the oldest manuscript of the Yasna, a present from a distinguished High Priest of the Parsis, a scholar renowned for his five-volume dictionary of the Pahlavi tongue. The Clarendon Press expressed its appreciation in a *de luxe* edition of the manuscript, which is the equal of any specimen of bookmaking produced in the nineteenth century. Spurred on by his first success, Dr. Mills was indefatigable in his efforts to obtain by purchase or gift the valuable manuscripts, or to obtain "diplomatically exact" copies of those he could not acquire, all for the ambitious end of seeing the Bodleian in possession of the finest collection of Parsi manuscripts in Europe.

Dr. Mills's mastery of languages was astounding, nor was he satisfied with a superb mastery of Iranic dialects, but to demonstrate the near relationship of Parsi to Sanscrit he deliberately and successfully translated a large portion of the Parsi sacred books into that difficult and ancient tongue. He was ever busy in learned societies and their publications with tongue and pen furthering the knowledge of his beloved science, and the Open Court Publishing Company has had the esteemed pleasure of printing a number of his volumes, such as the second and enlarged edition in 1900 of the *Gāthas,* originally published in 1892-4, as far as completed; *Zarathushtra, Philo, the Achaemenids and Israel* in 1906, being the two volumes in one of his university lectures, which were published as Vol. I in 1904 and Vol. II in 1905; a further collection of university lectures in 1908 under the title *Avesta Eschatology, Compared with*

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the Books of Daniel and Revelations; and finally, in 1913, *Our Own Religion in Ancient Persia.*

Another fruit of Dr. Mills's professional labors at Oxford, with which he was connected from 1898 on, is the *Dictionary of the Language of the Gāthas,* of which the first volume appeared in 1902 and the last in 1914, the fitting and final labor of a great and useful life.

CURRENT PERIODICALS.

Edward V. Huntington ("On Setting up a Definite Integral without the Use of Duhamel's Theorem," *American Mathematical Monthly,* Vol. XIV, 1917, pp. 271-275) makes a contribution of importance in the principles of the integral calculus. Consider the usual process of setting up an integral in the problem, say, of finding the total attraction P due to a thin rod of length $b-a$ at a point O in line with the rod and at distance a from the nearer end. Suppose the linear density of the rod to be any function, $f(x)$, which is known for all values of x from a to b. Also, suppose the attraction due to a particle to be proportional to $F(x)$ times the mass of the particle. We actually proceed somewhat as follows. First, we think of the rod as divided into small elements, dx, where $dx=(b-a)/n$, and proceed to write down the attraction due to a typical element, say, from $x=x$ to $x=x+dx$. Thus, the mass of the element is seen to be $f(x)dx$, at least approximately—and the formula would be exact if the density throughout the element were the same as at its nearer end. Hence, the attraction at the point O due to the element $kF(x)f(x)dx$, at least approximately—and the formula would be exact if all the attracting material in the element were concentrated at its nearer end. In this k is a factor of proportionality. Having thus found the attraction due to a typical single element, at least approximately, we get the total attraction, P, due to all the elements, by integrating the last expression from a to b, "and in spite of the approximation used in setting up the integral, we feel assured that this final expression for P is exact."

Now, in many text-books, notably W. F. Osgood's *Calculus* of 1907 (revised edition 1909), the process of setting up an integral as the limit of a sum is held to require, for complete rigor, the use of "Duhamel's theorem." This theorem is as follows. If $\alpha_1, \alpha_2, \ldots \alpha_n$ is a set of positive infinitestimals such that

$$\lim[\alpha_1+\alpha_2+\ldots+\alpha_n]=A,$$

and if $\beta_1, \beta_2, \ldots \beta_n$ is a second set of positive infinitesimals such that each β differs from the corresponding α by an infinitesimal of higher order, so that $\lim[\beta_i/\alpha_i]=1$; then

$$\lim[\beta_1+\beta_2+\ldots+\beta_n]=A.$$

In these the limits are taken for n going to infinity. This theorem has exceptions, and examples of this falsity of the theorem are given, and it is to be noticed that although Osgood recognized this in a paper in 1903, he retained the incorrect form of Duhamel's theorem, without comment, in his text-book. Osgood gave his reasons for so doing in his article of 1903. If Duhamel's theorem is to be used at all, it must be taken in a modified form; and modified forms have been proposed by Osgood (1903), R. L. Moore (1912), and G. A. Bliss (1914). However in this article Huntington shows that the simple and uncritical process of integration regarded as a method of summation can be counted on to yield the correct result in the case, at least, when the functions $f(x)$ and $F(x)$ are continuous. "It is not necessary to consider any questions of 'infinitesimal of higher order,' or any questions of 'uniformity'; the simple continuity of the two functions is sufficient." This theorem is stated and proved at some length.

* * *

Louis C. Karpinski ("Algebraical Developments among the Egyptians and Babylonians," *American Mathematical Monthly*, Vol. XXIV, 1917, pp. 257-265) tries to show that "much of the material of our elementary algebra was long ago anticipated, to some extent, in the Orient. Similar anticipations of algebraical reasoning are indicated in the material, such as we have, which shows the progress of mathematics in ancient India and Greece.... In interpreting historical evidence one is constantly in danger of reading modern ideas into the text; on the other hand some writers in discussing Egyptian mathematics have been at great pains to discount the material which we have.... The Egyptians, even as early as 2000 B. C., attained a relatively high development in mathematics along analytical lines. This advance was made by the Egyptian priests who enjoyed that adequate leisure which is a primary essential for scientific advance. The assumption has frequently been made that the mathematics of the Egyptians was the product of their practical needs, this view being the result of a too serious regard for the statement of Herodotus that the Egyptians developed

geometry in order to redistribute the lands after the periodic overflow of the Nile. The assumption is absolutely refuted by a study of their mathematical achievements.... A just view of the mathematics involved must regard these points [practical application of mathematics] as applications and not at all as sources of the Egyptian mathematics. Fundamentally and universally mathematics is the achievement of thinking beings, occasioned by the mind and not by the body." Speaking of the Rhind papyrus, the author says that "the manual includes a number of problems in linear equations. The solution while essentially by the method of 'false position' is a definite and scientific procedure, leading to the correct value of the root of the equation. One of these first-degree equations is the following: '*Ahau* (heap, mass, unknown) and its seventh, it makes 19.' An arbitrary value, 7, is assumed as the root and the sum is found to be 8, instead of 19 as required; to obtain 19 from 8 the latter is doubled and multiplied by ¼ and ⅛; the trial root 7 is also multiplied by 2, ¼, ⅛, giving 16, ½, ⅛ as the value of the unknown; substitution of this value in the original equation follows, as a check, in accordance with the common procedure in Egyptian mathematics." After mentioning that symbols for the unknown, addition, and subtraction, and that simultaneous equations in two unknowns, leading to pure quadratics involving the Pythagorean triad $3^2+4^2=5^2$ are found in this and other ancient papyri, the author notices "that the Egyptian system of unit fractions, which persisted in Europe three thousand years after the times of the Ahmes manual, frequently gives a convenient method for actual computation." Also "the discussion in the Egyptian manual of arithmetical and geometrical progressions reveals an unexpected familiarity with rules which we now express by algebraical formulas, a familiarity which has not received adequate appreciation." There is mention of the weak point, which is apparently universal in Egyptian mathematics, in the discussion of the areas of triangles and trapezoids. "It is difficult to reconcile these crude approximations with the precision of measurements found in the construction of the pyramids and with the use of a method for drawing similar figures corresponding to the use of cross-section paper. The authorities are not in full agreement concerning the interpretation of the texts in question." In the section on algebraical ideas in Babylon, the author mentions the astronomical work of the Babylonians, their number symbols and decimal

and sexagesimal systems (the sexagesimal place system of recording numbers appears as early as 3000 B. C.), and the interest on the part of the Babylonians in arithmetical and geometrical series as early as 700 B. C. and in square and cubic numbers. "This brief survey of algebraical developments among the Egyptians and Babylonians shows that much of the material which was developed and extended by Greek mathematicians originated, both in methods and substance, with the scientists of the Orient." Φ

BOOK REVIEWS.

RELIGION AND SCIENCE: a philosophical essay. By *John Theodore Merz*. Edinburgh and London, Blackwood and Sons, 1915. Pages, xi, 192. Price, 5s. net.

Clearly, this book belongs to a type. To be in love with emotion has been our affliction since Rousseau; to believe in belief is a form of the same malady. Mr. Merz knows Schleiermacher; he may or may not have read Maeterlinck, or Bergson, or Jean Jacques; but he cannot have escaped Goethe. As for romanticism in theology, we find one fundamental assumption: there is something called religion, independent of articulate creeds; there is the conviction that religion is so valuable that it must be "true"; and there is the prejudice that science is hostile to religion. Strong passions do not need explanation; but just as a man who is not very much in love excuses the follies which he has committed for the purpose of appearing passionate, so the philosophical Christian apologizes for the religion in which he would like to believe, and interprets the weakness of his opponents as evidence of his own strength. Maeterlinck exulted in the "*banqueroute de la science*" because it made religion again possible.

In this book the learned historian of European thought expounds three ideas: (1) Science deals only with an "external" world, which is a development of the world of common sense "with a still greater restriction of fundamental data" (p. 107) out of an earlier and larger reality. (2) Science describes and explains, its terms consist of "spatial data and their connections." Interpretation, i. e., the assignment (or the discovery?) of value and meaning, is reserved for religion. (3) Personality is that which is most real. The highest experience which we can have is the feeling of absolute dependence (Schleiermacher) which we trace to the influence of a higher power.

Mr. Merz decides, first, that the external world is a construction, that conceptual thought abstracts and selects. The products of this selection are subject and object, "an altered and fuller conception of reality," space, time, causality. These entities are carved out of a "primordial stream of thought" which apparently antedates thinking, which is a reality wider (though it is said to be less "full") than the external world. This internal possession is

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the earlier and truer aspect of our personality—a period (as well as an aspect) when we looked upon everything merely as "internal happenings." We entertained this hypothesis in our infancy, and our age sees the belief justified.

Although this is the earlier and truer aspect of our personality, yet contact with other personality leads us out of it. The first external object that the baby apprehends is its mother, not perhaps in her earlier and truer aspect, but as an influence, a spiritual pressure. Nothing else that we experience is so real as personality. The awareness of a group gives us law and morality. The awareness of a supreme spiritual pressure gives us religion.

Mr. Merz holds that mind is as much an abstraction as is matter. "The totality of experience....is of more importance, being more real, than the particles into which we dissect it" (p. 72). Whether personality is equivalent to this total experience, or is one of the particles, is not made clear.

The phrases "stream of thought" and "firmament of consciousness" recur many times. The account of description, explanation, and interpretation is the best part of the book (pp. 110-120). ¶

OUTLINES OF JAINISM. By *Jagmanderlal Jaini, M.A.* Edited with preliminary note by *F. W. Thomas.* Cambridge: University Press, 1916. Pp. xl, 156. 4s. net.

A compact little treatise by a distinguished Jain. The author divides his exposition into Theology, Metaphysics, Ethics, and Ritual, and appends a number of Jain texts. The book is a compendium, not an interpretation into terms of western philosophy—which is to its credit. It will appeal chiefly to the student of Sanskrit and Pali who has some acquaintance with Indian and Buddhist philosophy, and perhaps is ignorant in this less explored field; but it should interest others as well. We regret that the author did not find space for a comparative account; we learn nothing of borrowings, analogies, or common sources. There is an historical narrative of the teachings of Jainism, but none of the development of its philosophy. Jainism is dualistic, and one would like to know what relation it bears to the dualism of early Sankhya. From Mr. Jaini's statement of the three cardinal principles (karma, relativism, and ahimsa or non-injury of living beings) we do not discern any fundamental difference from some forms of Buddhism.

One is glad to see that honor is paid to the labors of that greatest of orientalists, Jacobi. The book is published under the auspices of the Jain Literature Society. We hope that it will spread the interest in a noble religion and ethics and an important philosophy. ¶